GX 770

intra-oral x-ray system

installation/maintenance manual

THIS MANUAL MUST BE RETAINED AT INSTALLATION SITE.

GENDEX

IMPORTANT! . . . X-RAY PROTECTION

X-ray equipment may cause injury if used improperly. The instructions contained in this manual must be read and followed when operating the GX-770. Gendex dealers will be glad to assist you in placing the GX-770 in operation.

The GX-770 provides a high degree of protection from unnecessary X-radiation. However, no practical design can provide complete protection, nor prevent operators from exposing themselves or others to unnecessary radiation.

It is important that you be fully acquainted with applicable government radiation protection regulations. Many provisions of these regulations are based on the recommendations the National Council on Radiation Protection and Measurements. Recommendations for dental X-ray protection are published in NCRP Report Number 35 available from NCRP Publication, P.O. Box 30175, Washington, D.C. 20014.

Personal radiation monitoring and protective devices are available. You are urged to use them to protect against unnecessary X-radiation exposure.

FOREWARD

This direction provides information to assemblers for installation of the GX-770. The installation data includes assembly, check-out, adjustment and certification procedures. (Sections 2 through 6)

This direction also provides procedures to be followed for periodic scheduled maintenance. (Sections 3 through 6)

Basic service data is also provided to include basic theory, troubleshooting and parts. (Sections 9 and 10)

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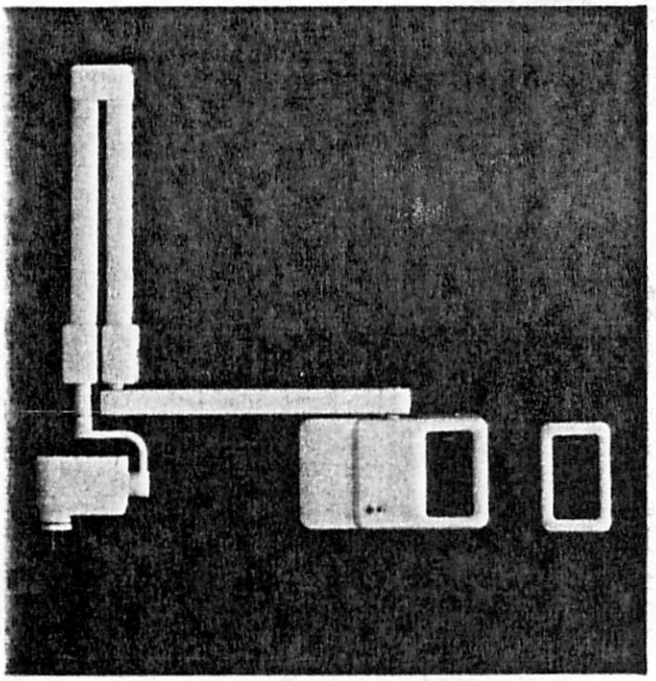
SECTION 1 — PREINSTALLATION

INTRODUCTION

The purpose of this Section is to provide preinstallation information for the GX-770 Intra Oral X-ray System.



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CERTIFIED COMPONENT COMPATIBILITY

The GX-770 System consists of the following certified, compatible components, manufactured by GENDEX.

Component	Model No.	Label Location
Tubehead	46-404650G1	back of tubehead
Master Control 120V 60HZ	46-404600G1	bottom
8" focal length cone	46-404653G2	around base
12" focal length cone	46-404653G1	around base
Remote Station	46-404725G1	left side

The suspension is Model No. 46-404770G1 and is not required to be certified.

ACCESSORIES

The following are available for optional purchase:

A 0771 A	Remote Station Kit
A 0772 A	4X4 Mount
A 0773 A	Special Mounting Fixture
D 0774 A	12 inch Cone
D 0774 B	8 inch Cone
A 0778 A	Special Length Remote Cable
A 8108 AA	Remote Switch

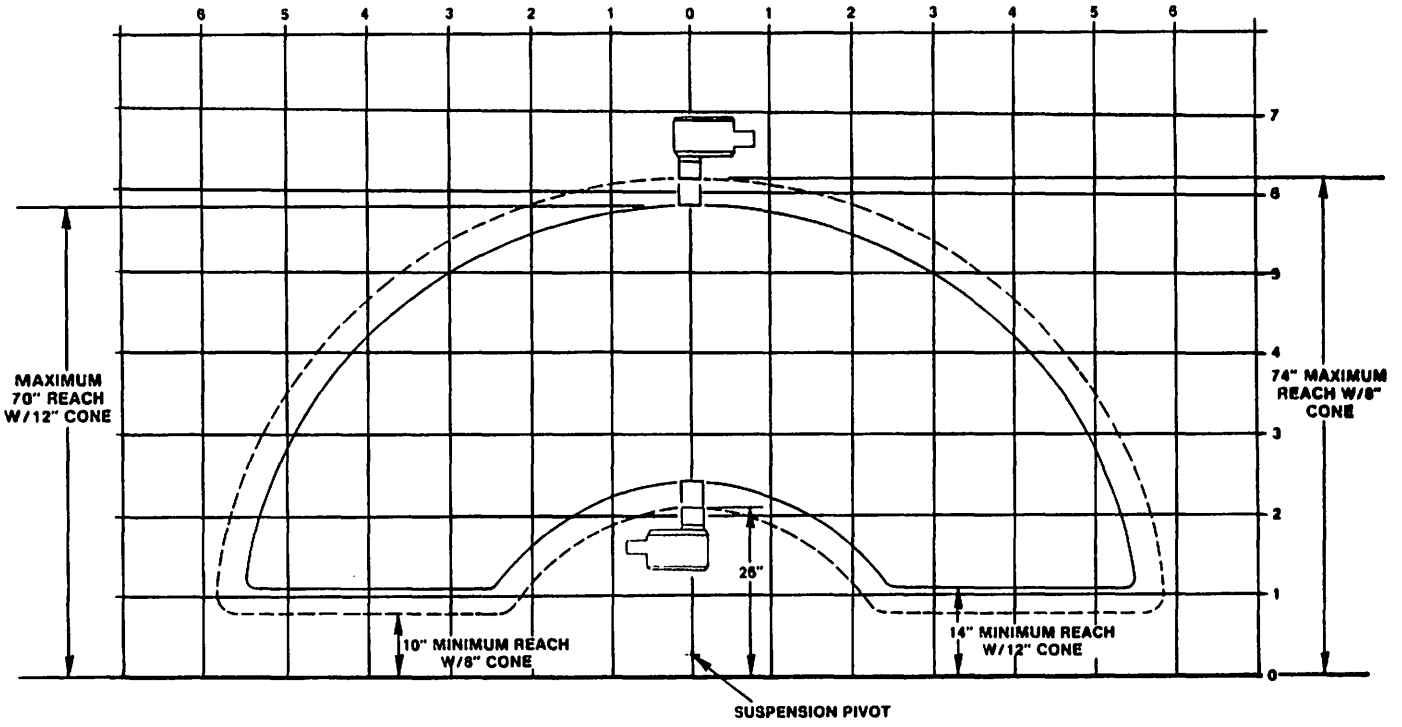
REACH AND COVERAGE

The plan below, Figure 1-1, shows the top view of a typical location with the maximum area of coverage indicated by a dashed line. A patients head may be located anywhere within this area. The dimensions of this area are reduced by about four in. (10 cm.) when a 12 inch (30.5 cm) cone is used, as shown by the solid line. A reference grid, at 1 ft (30.5 cm) intervals, is shown with respect to the suspension center.

A side view for reach and coverage is shown in Figure 1-2. Dimensions and profiles are shown in Figures 1-3 and 1-4.

The handswitch is attached to the system with a coiled cord. The handswitch can be extended 12 feet (3.66 meters) from the control to allow the operator to reach a position at least 6 ft. (1.83 meters) from the patient. The operator must also be out of the path of the primary beam of the tubehead. Use of a Remote Station or Remote Exposure Switch can also provide this function.

Reach and Coverage
(Top View)



REACH AND COVERAGE ARE THE SAME FOR THE WALL PLATE, 4X4 AND SPECIAL MOUNTING FIXTURE.

Figure 1-1

Reach and Coverage (Side View)

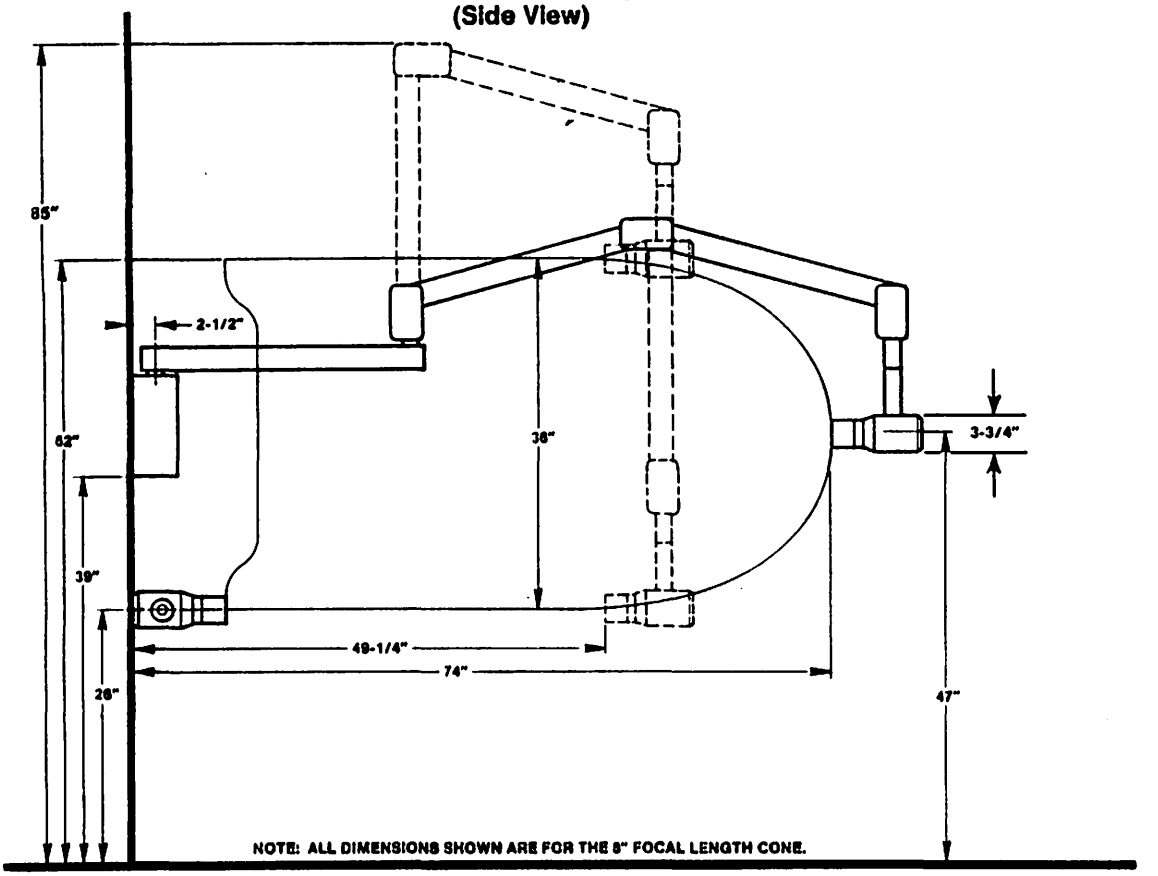
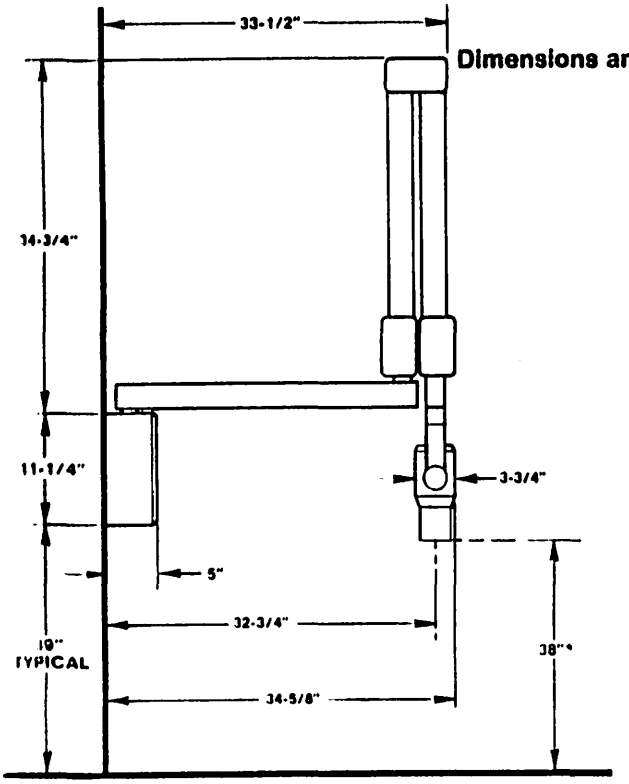


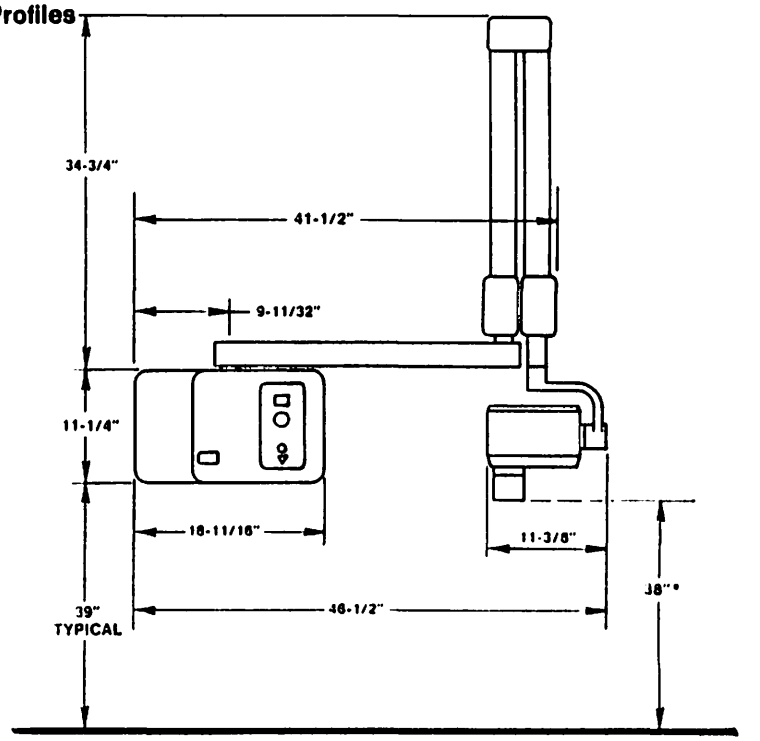
Figure 1-2

Dimensions and Profiles



*DISTANCE WITH 8" FOCAL LENGTH CONE AND UNIT MOUNTED 39" ABOVE FLOOR.

Figure 1-3



*DISTANCE WITH 8" FOCAL LENGTH CONE AND UNIT MOUNTED 39" ABOVE FLOOR.

Figure 1-4

SUPPORT REQUIREMENTS

The basic structual and hardware requirements for mounting the GX-770 Master Control, 4X4 Mount and Special Mounting Fixture are the same. They only differ in the placement and the number of mounting screws or bolts used as well as the increased support requirements for the special mounting fixture. Six lag screws are supplied for the GX-770 Master Control while three are supplied for the 4X4 Mount. Mounting hardware is not supplied with the Special Mounting Fixture due to the variety of mounting situations which might be encountered.

For all types of wall construction, the mounting hardware for the Master Control with suspension and 4X4 mount must withstand a 100 lb. (45 kg.) shear load and 400 lb. (182 kg.) withdrawal force at each of the mounting bolts or screws. See Figure 1-5 for suggested wall construction when the Master Control Wallplate is used. See Figure 1-6 for 4X4 mount. For the special mounting fixture, the hardware must withstand a 200 lb. (91 kg.) shear load and a 1500 lb. (680 kg.) withdrawal force at each of the four mounting bolts or screws. The wall fabrication and attachments to the building structure must be capable of withstanding a load moment force of 850 ft. lbs. (118 kg.m.).

NOTE: When mounting hardware, other than the lag screws shipped with the units, is used, the total thickness of the washer, nut and any protruding bolt or threaded rod on the wall plate side must not exceed 3/8 inch.

Mounting requirements for the Remote Station are, 10 lb. (4.5 kg.) shear load and 20 lb. (9 kg.) withdrawal force at each of the four mounting points.

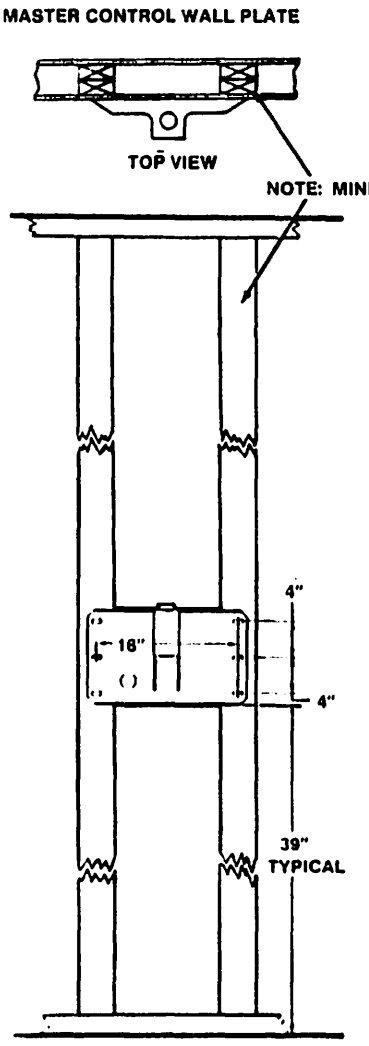


Figure 1-5

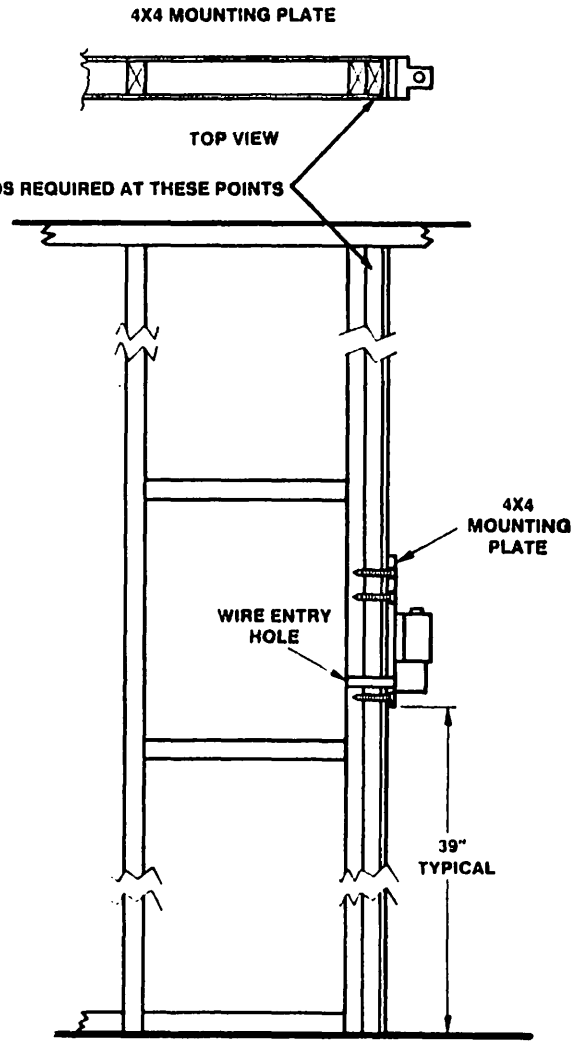


Figure 1-6

ELECTRICAL POWER REQUIREMENTS

Line Voltage range: 110 volts minimum to 130 volts maximum, no load

Maximum line current: 10 amperes during exposure

Maximum line regulation: 3%

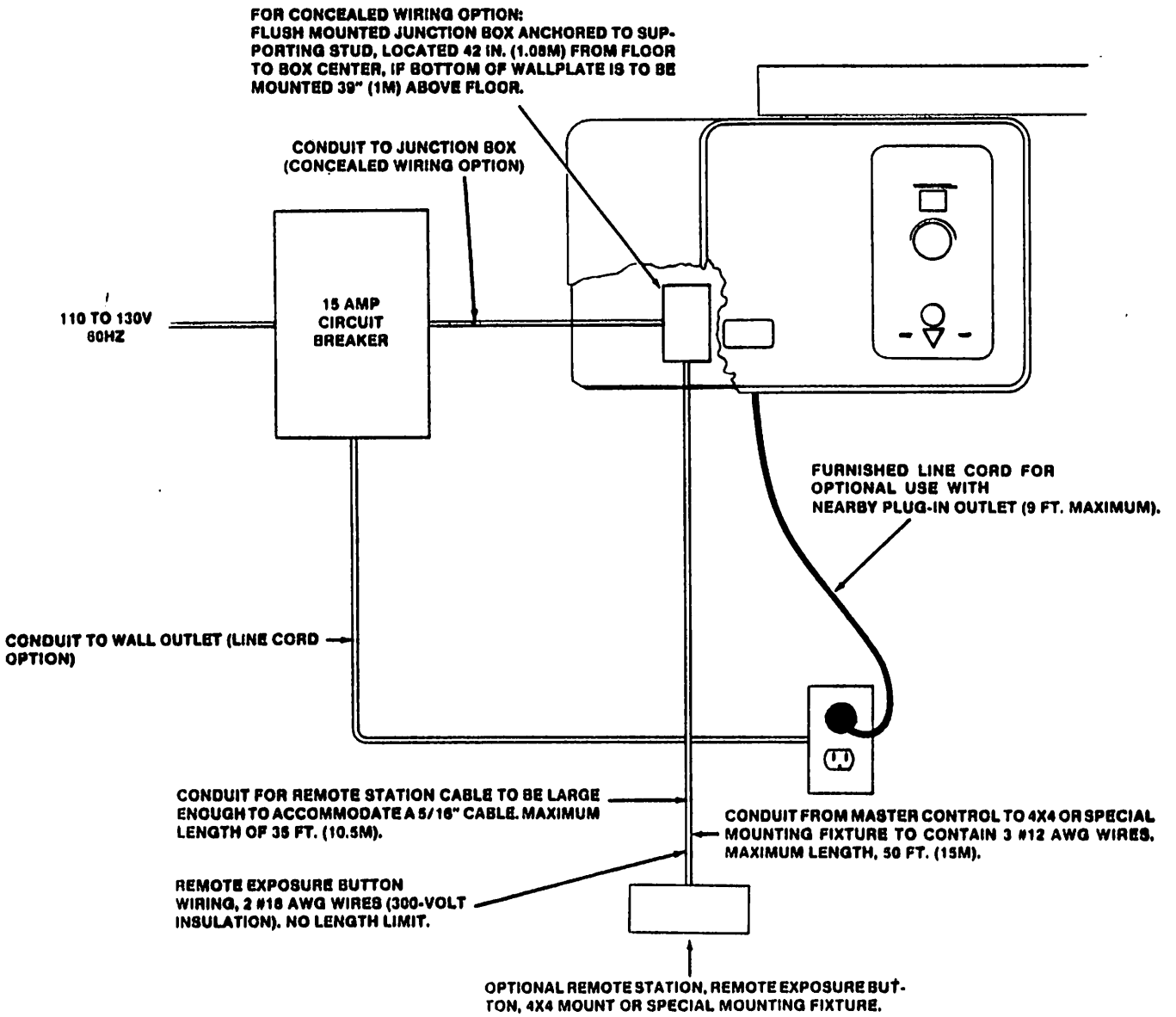
Conduit from electrical service distribution center to junction box or wall outlet to contain:

Power "hot" wire, Power wire neutral and ground wire.

#12 wire — up to 100 ft. (30 M)

#10 wire — 100 ft. (30 M) to 150 ft. (46 M)

The circuit should be on a separate fuse or circuit breaker, rated at a minimum of 15 amps. No other load should be operated on the circuit.


FOR CONCEALED WIRING OPTION: FLUSH MOUNTED JUNCTION BOX ANCHORED TO SUPPORTING STUD, LOCATED 42 IN. (1.08M) FROM FLOOR TO BOX CENTER, IF BOTTOM OF WALLPLATE IS TO BE MOUNTED 39" (1M) ABOVE FLOOR.
CONDUIT TO JUNCTION BOX (CONCEALED WIRING OPTION)
110 TO 130V 60HZ
15 AMP CIRCUIT BREAKER
FURNISHED LINE CORD FOR OPTIONAL USE WITH NEARBY PLUG-IN OUTLET (9 FT. MAXIMUM).
CONDUIT TO WALL OUTLET (LINE CORD OPTION)
CONDUIT FOR REMOTE STATION CABLE TO BE LARGE ENOUGH TO ACCOMMODATE A 5/16" CABLE. MAXIMUM LENGTH OF 35 FT. (10.5M).
CONDUIT FROM MASTER CONTROL TO 4X4 OR SPECIAL MOUNTING FIXTURE TO CONTAIN 3 #12 AWG WIRES, MAXIMUM LENGTH, 50 FT. (15M).
REMOTE EXPOSURE BUTTON WIRING, 2 #18 AWG WIRES (300-VOLT INSULATION). NO LENGTH LIMIT.
OPTIONAL REMOTE STATION, REMOTE EXPOSURE BUTTON, 4X4 MOUNT OR SPECIAL MOUNTING FIXTURE.

CERTIFICATION

The certified components of the GX-770 system comply with Radiation Performance Standards 21 CFR, Subchapter J, at time of manufacture.

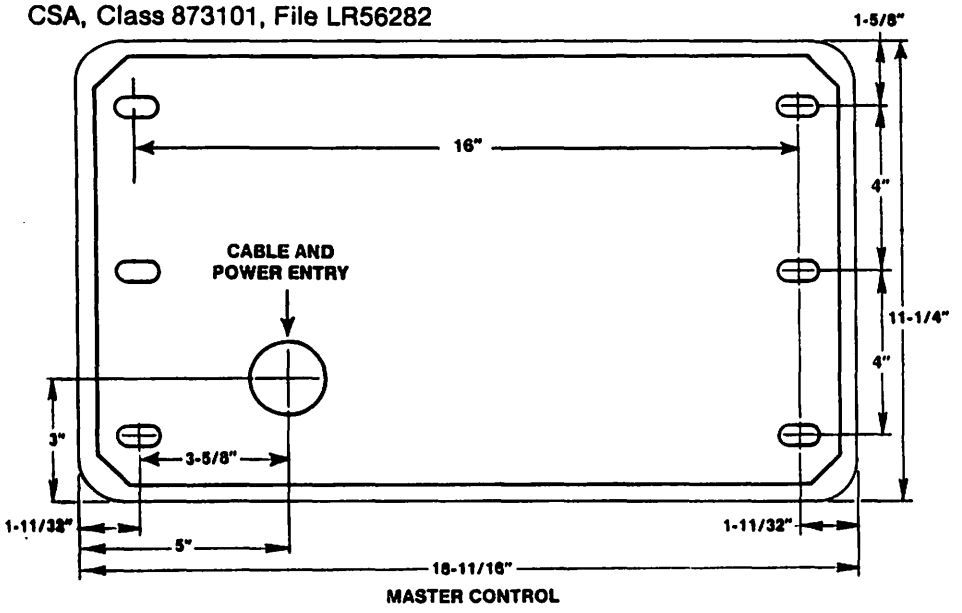
UL and CSA

X-ray equipment classified by Underwriter's Laboratories, Inc., with respect to electrical fire, shock, and mechanical hazard. See U/L Guide ZQ0R, File No. 87724.

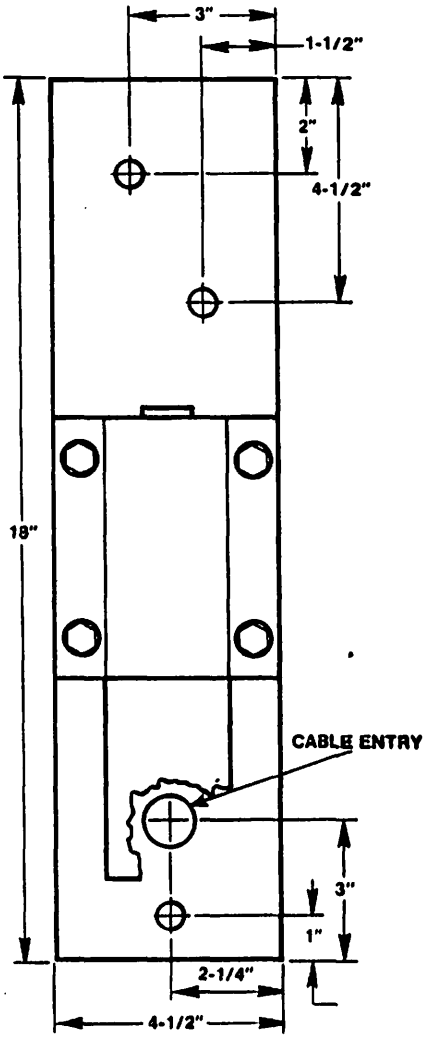
CSA, Class 873101, File LR56282

ENVIRONMENTAL LIMITATIONS

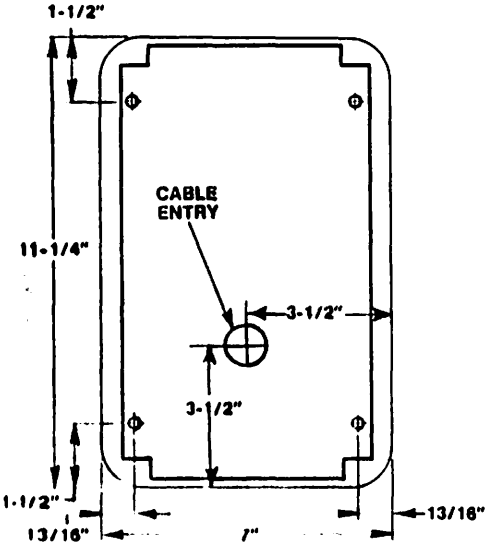
Cooling and duty cycle rating specifications apply at altitudes up to 12,000 feet (3,600 M) average relative humidity not to exceed 95 percent, and maximum ambient temperature not exceeding 80 degrees F (27 degrees C).



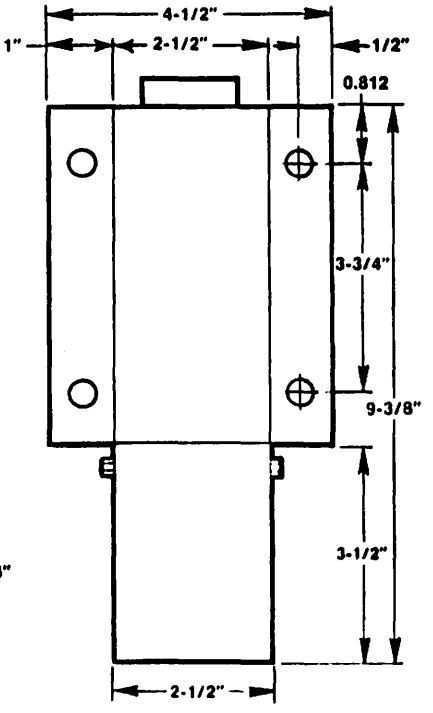
MASTER CONTROL



4X4 MOUNTING PLATE



REMOTE STATION



SPECIAL MOUNT

SECTION 2 — INSTALLATION

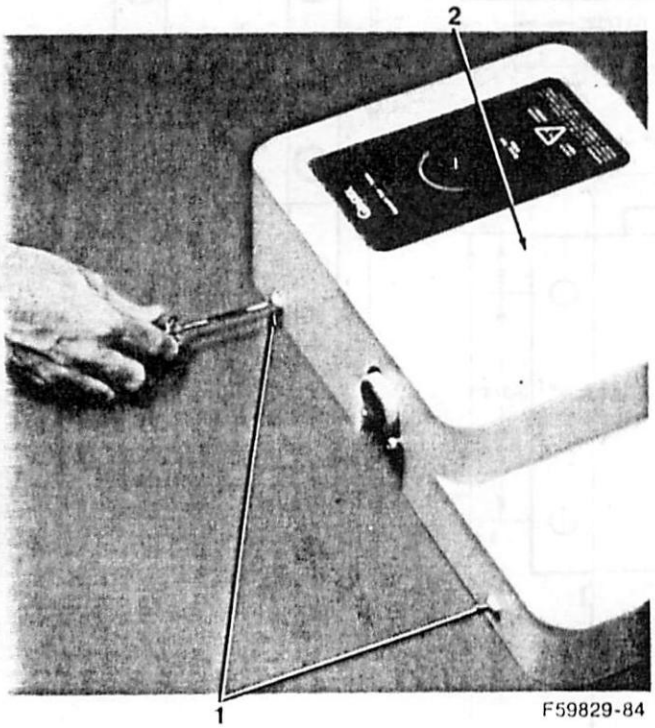
FOREWARD

Prior to beginning the installation, be sure all preinstallation requirements have been completed. This includes confirming that support requirements are adequate for mounting the unit and that the electrical power requirements and entrance locations are proper. Preinstallation requirements for a Remote Station or Remote Exposure Switch should also be complete at this time. If needed, refer to Section 8 for details.

NOTE: If a Remote Station Kit is to be installed, refer to Section 8 or installation instructions shipped with each kit. The GX-770 should be installed and electrical calibration complete **prior** to installation of the Remote Station.

If the installation is to consist of a 4X4 or special mounting fixture, remoted from the wallplate master control, see directions on page 2-11 of this section.

1. Remove the four screws with washers which hold the cover in place, 2 on the top and 2 on the bottom.
2. Lift off the cover and put aside in a safe location.



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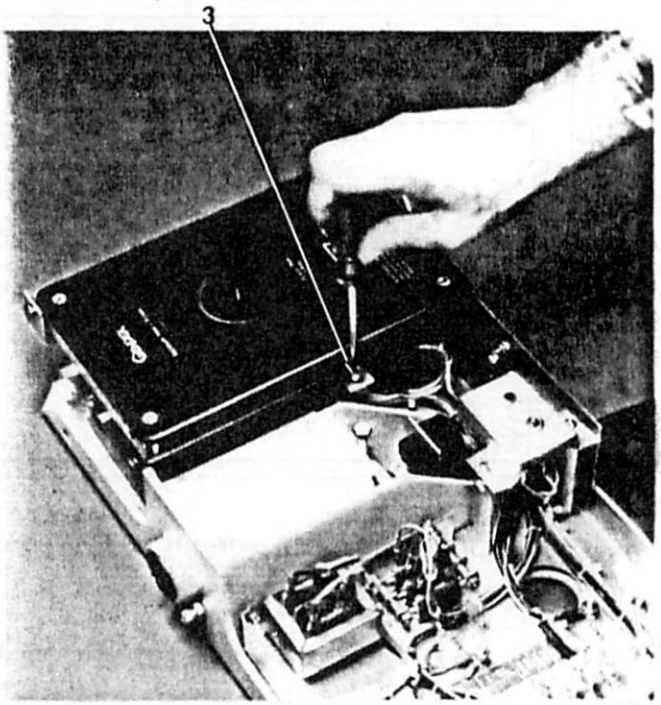
3. Remove the screw located just to the left of the Timer Control board. The Timer Control Board chassis is hinged and can now swing to the right to allow access to the electrical sub-chassis. Remove the four nuts holding the electrical sub-chassis to the wall plate.



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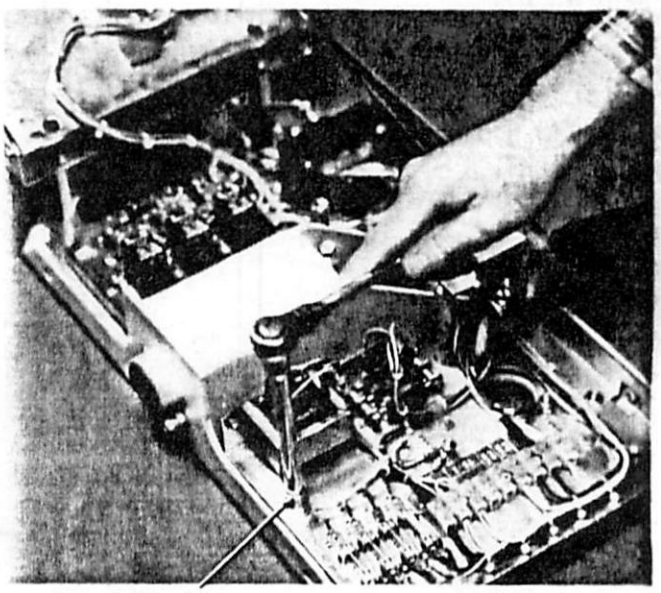

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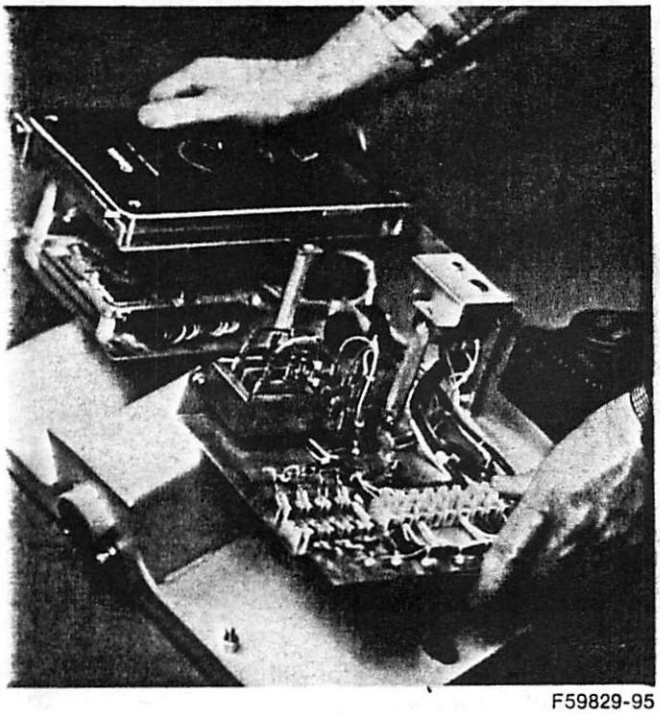
4. Lift off the electrical sub-chassis, being sure to protect the handswitch and power cord. Set aside in a safe location.



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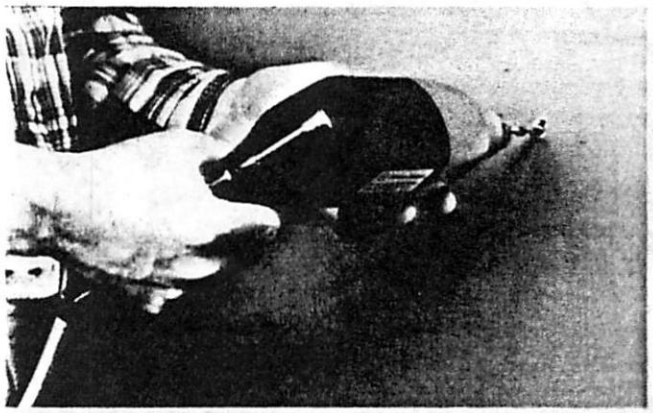
NOTE: Steps 5 through 14 describe the procedures used to fasten the Master Control wallplate to a wall supported by wood studs on 16 in. (40.6 cm.) centers. See Section 1, Preinstallation for suggested wall construction. Lag screws are furnished for this type of mounting. When other hardware is used, the total thickness of the washer, nut and any protruding bolt or threaded rod on the wallplate side must not exceed 3/8 inch. For any wall construction, the selected mounting hardware to be used must be capable of supporting a 100 lb. (45 kg.) shear load and a 400 lb. (182 kg.) withdrawal force at each of the six mounting points. The wall fabrication and attachments to the building structure must be capable of withstanding a load moment couple of 850 ft. lbs. (118 kg.m.) The following procedure for mounting and leveling may be used, where applicable, for other types of hardware.

5. Mark the location for the bottom edge of the wall plate at 39 inches (1 m) above the floor. If the ceiling height is less than 87 in. (221 cm), then the mounting height must be lowered accordingly. The height may also be adjusted to accommodate the user's choice of a high or low base chair. Refer to Reach and Coverage chart on page 1-2 of Preinstallation Section for additional details.
6. Using a 1/16" drill bit, make several test holes to locate the centers of the studs. Verify that an adequate mounting space on 16 inch centers is present. If the power and Remote Station/ Exposure Switch wiring is to be concealed, the junction box, conduit and wiring should be installed at this time. Also verify that the junction box is located in the lower left corner off the wallplate and at the proper height.
7. Drill the hole for the lower left lag screw using a 1/4" drill bit. This hole will normally be 40-11/16" (1.04 m.) above the finished floor, if the bottom of the wallplate is to be 39" (1 m) above the finished floor. However if the mounting height in step 5 was altered, then this height must be modified accordingly.



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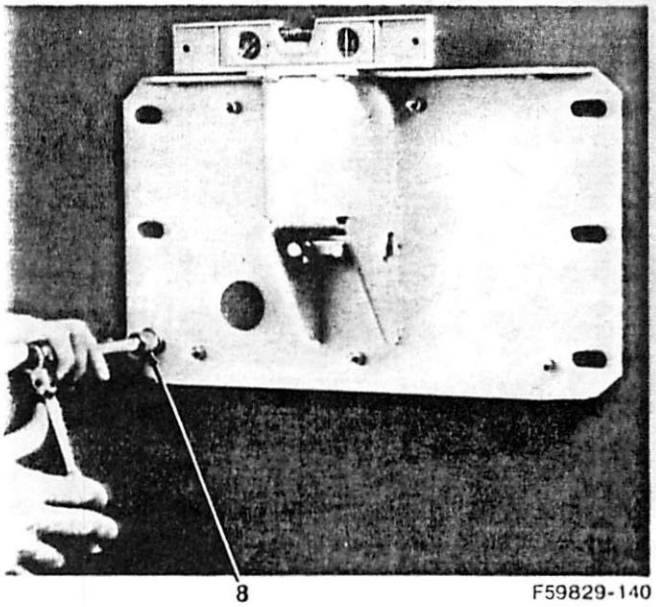
8. Lift the wallplate into position and install the lower left lag screw and washer. Level the wallplate side to side and tighten the lag screw.



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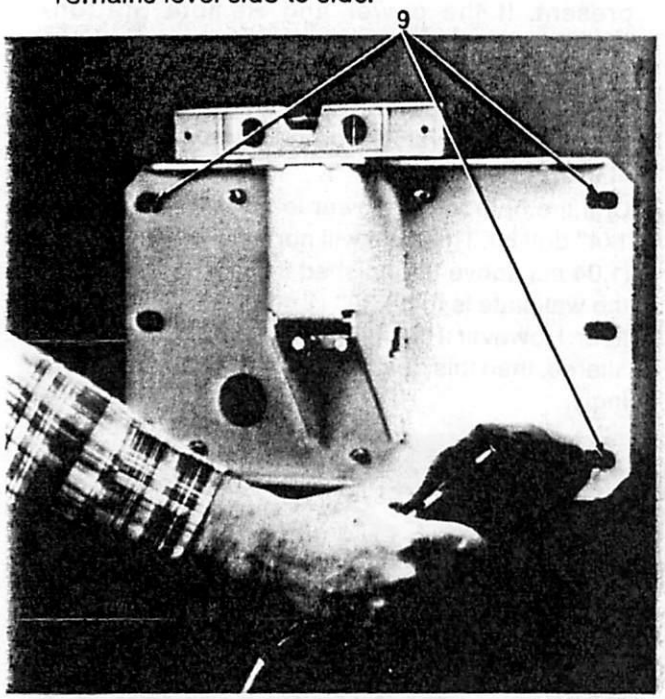
9. Drill holes for the other three corner lag screws using a 1/4 inch drill bit. Be sure that the wallplate remains level side to side.



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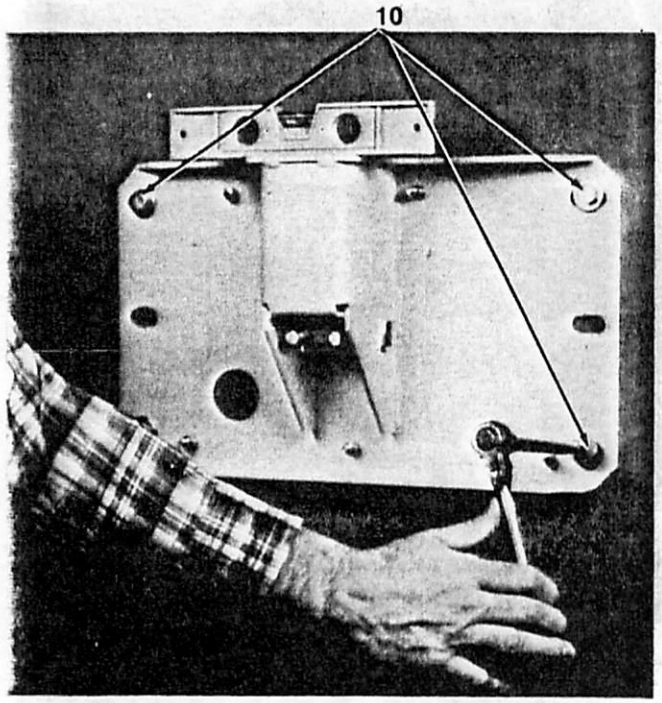
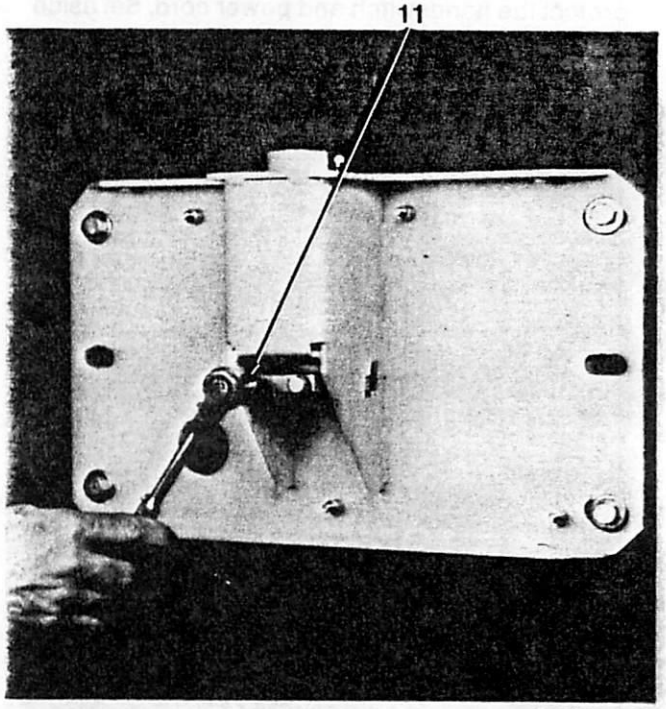
10. Install the remaining three corner lag screws and washers loosely.



F59829-142

11. Remove the horizontal arm brake.



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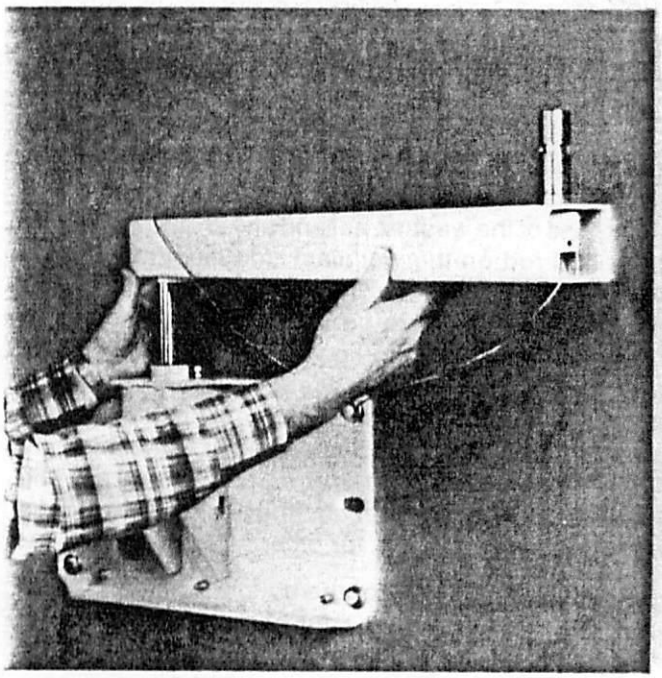
12. Install the horizontal arm with the long pivot post inserted into the wallplate.



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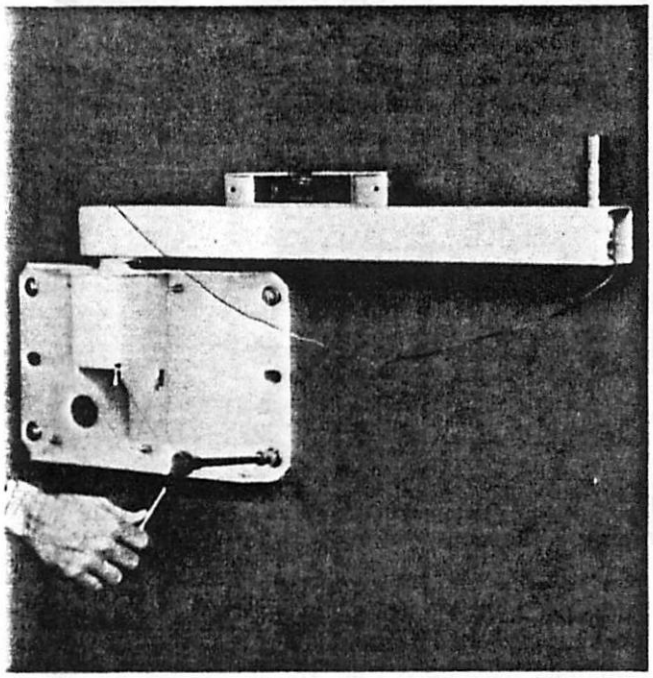
13. Check the level of the horizontal arm. When the wallplate is properly installed and leveled, the horizontal arm should be slightly out of level, wallplate end low, when the arm is parallel to the wall. The level should read the same when the arm is pivoted to the right or left side as well as perpendicular to the wall. Shim the wallplate if necessary. Tighten all screws securely.



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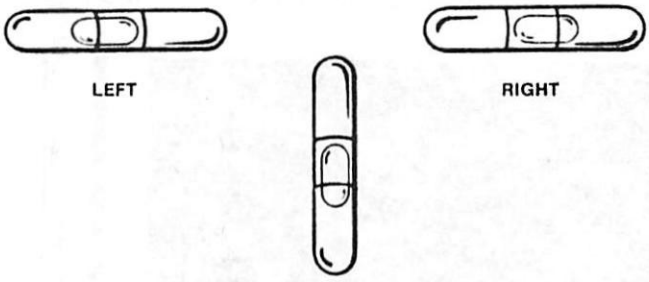
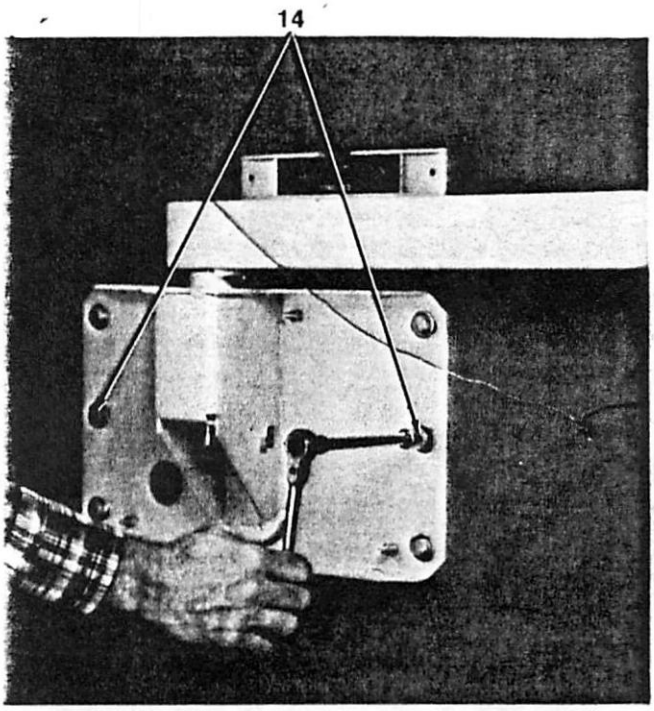


TYPICAL LEVEL INDICATION

14. Drill 1/4 inch holes for and install the remaining lag screws and washers.



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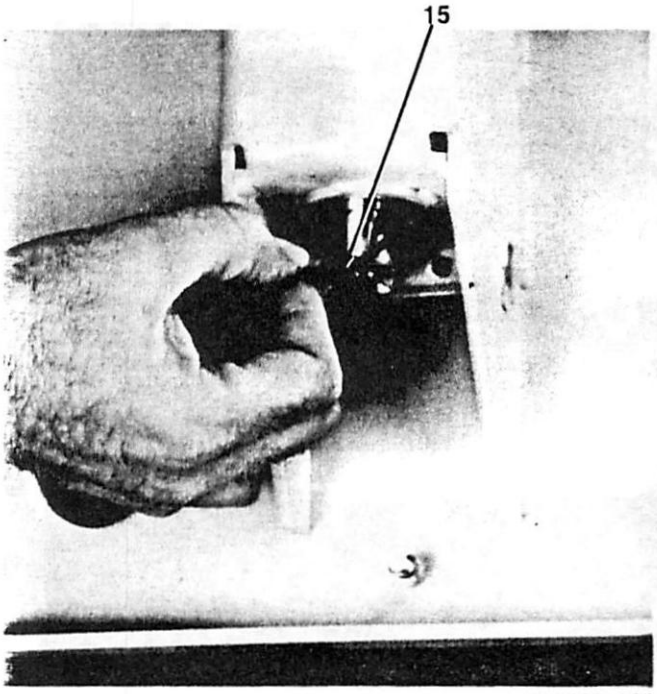
15. Install the retaining clip in the slot at the bottom of the horizontal arm pivot shaft.



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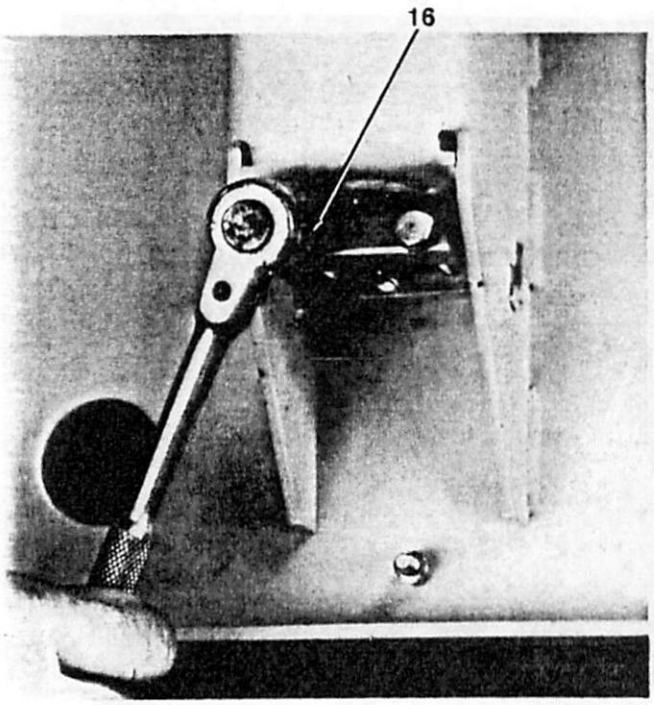
16. Reinstall the horizontal arm brake.



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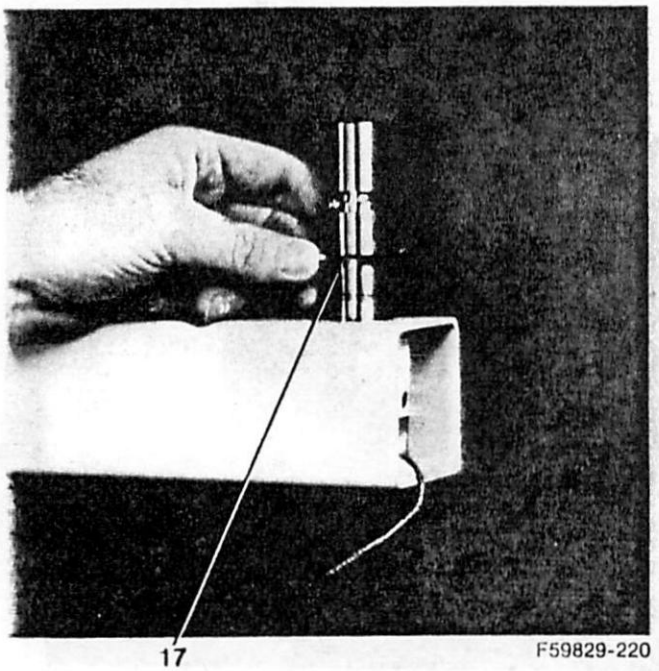
17. Install the thin washer on the horizontal arm pivot on which the pantograph arm is to be installed.



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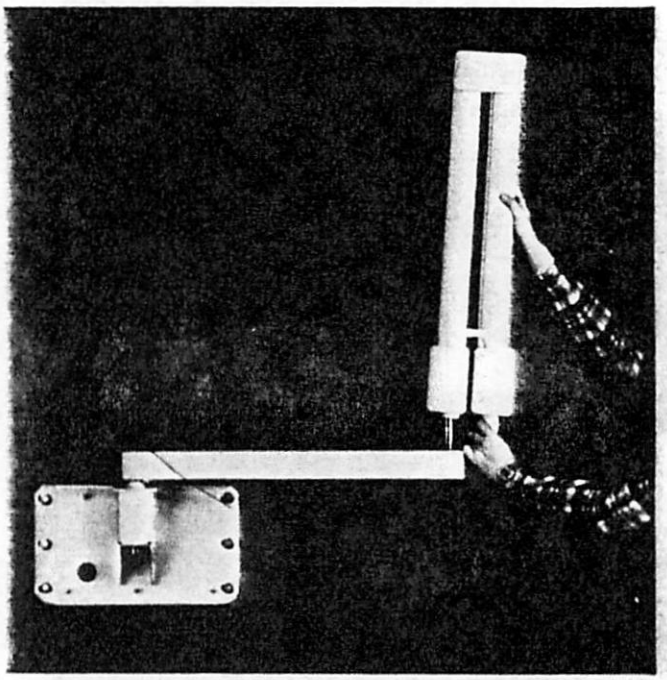
CAUTION

Do not remove tie wrap from the pantograph arm until the tubehead has been installed.

18. Install the pantograph arm in place on the horizontal arm pivot post. Keep the arm cable tight as it is pulled through the post.



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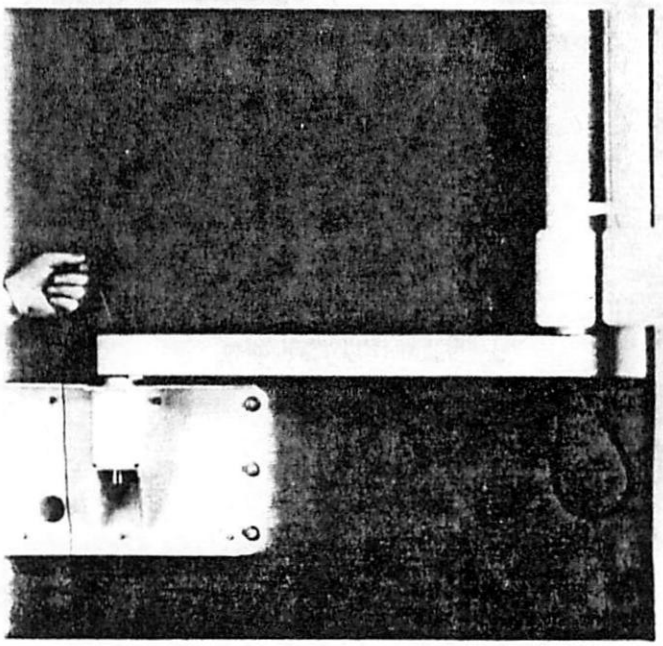
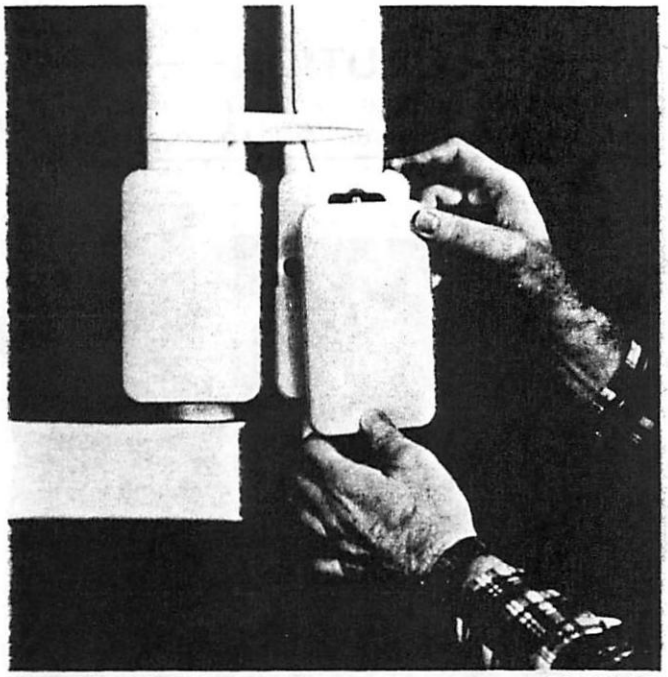
19. Use the string installed in the horizontal arm to pull the suspension cable through the arm and in to the wallplate assembly. Pull the cable through the horizontal arm completely before attempting to route the cable through the pivot post and into the wallplate.



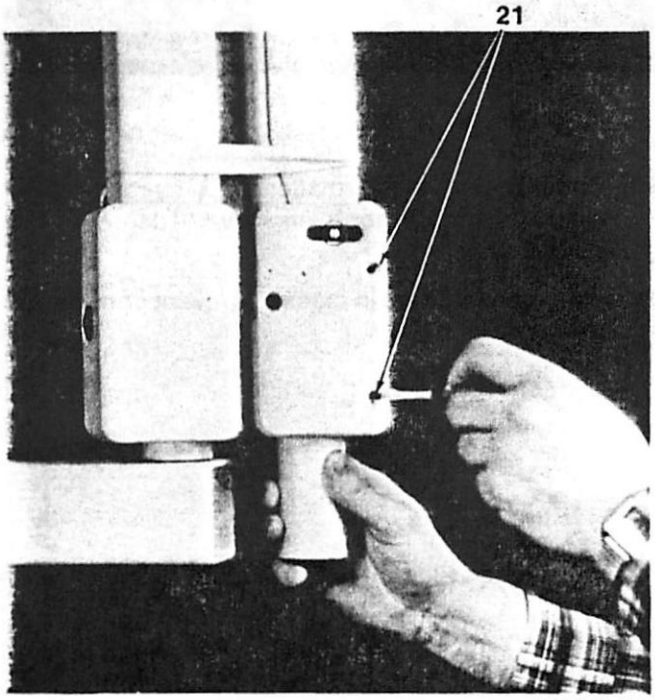
F59829-221

20. Remove the two side trim covers from the sides of the tubehead mounting assembly. The trim covers snap off from the sides.



F59829-229

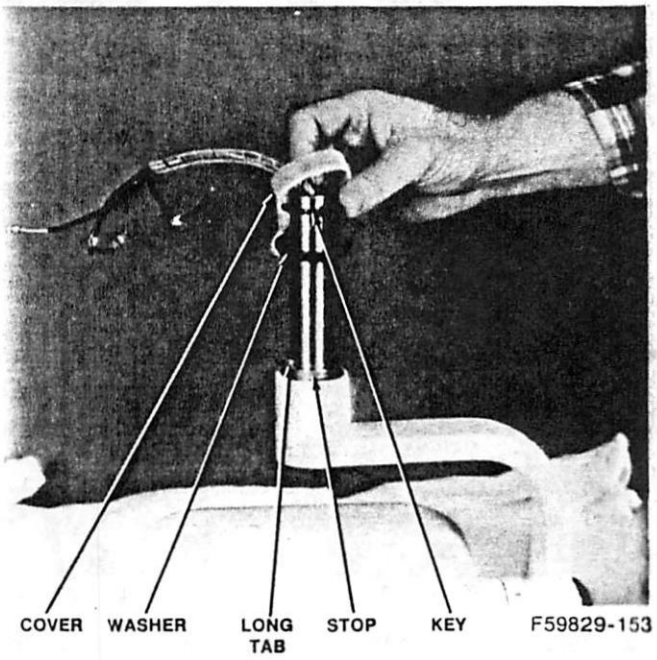
21. Remove tubehead wiring access cover by removing the four flathead screws, 2 on each side.



F59829-156

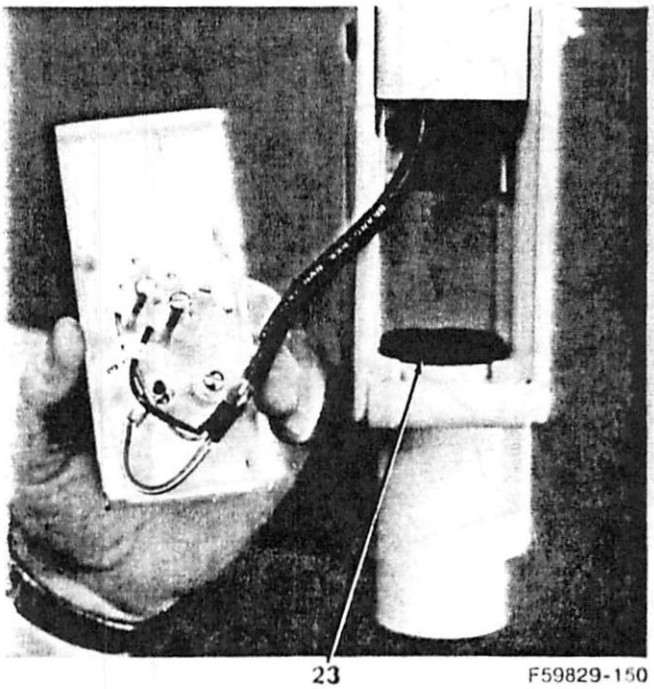
22. Remove the plastic retaining cover, key and keyed washer from the tubehead pivot post. Check to be sure that the rotation stop is in place on the tubehead pivot post.

NOTE: The long tab on the rotation stop must always be pointing up.



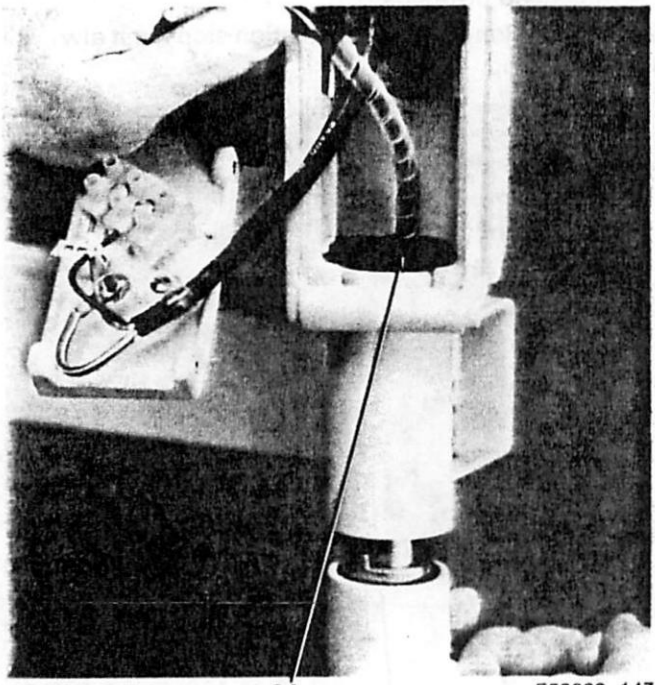
F59829-153

23. Place the keyed washer over the hole in the tubehead mounting assembly through which the tubehead pivot post is to be inserted.



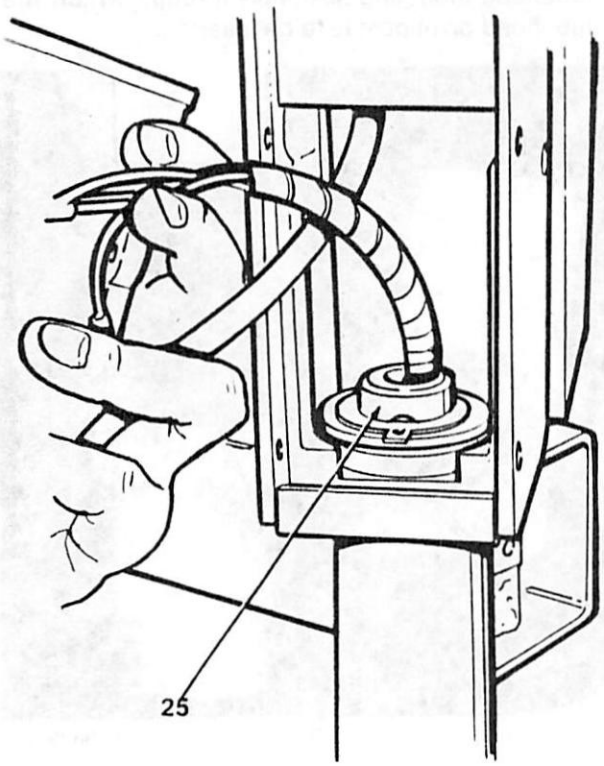
F59829-150

24. Install the tubehead pivot post into the tubehead mounting assembly and through the keyed washer.



F59829- 147

25. Install the key on the tubehead pivot shaft. Rotate the tubehead until the key fits into the hole in the pivot shaft and the slots on the keyed washer.

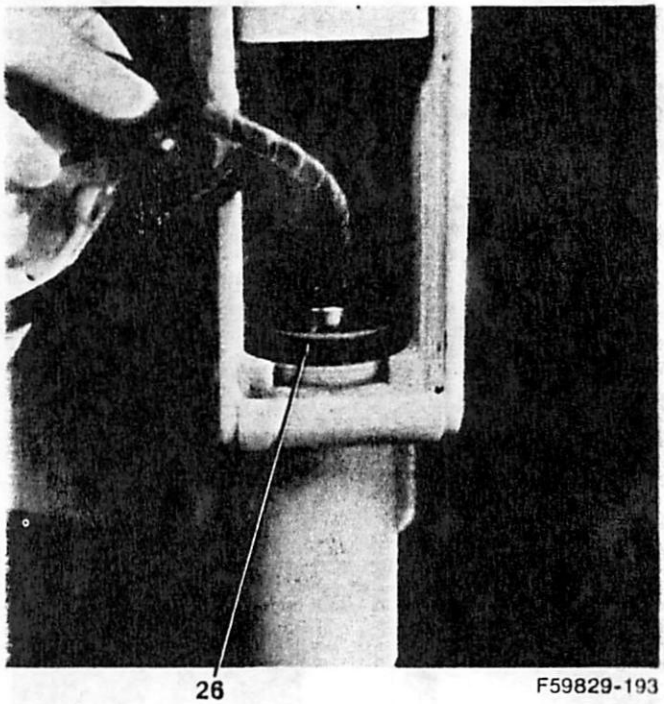


F59829-195

26. Install the plastic retaining cover over the tubehead wires and snap into place over the key and keyed washer.

CAUTION

The plastic retaining cover MUST be installed to prevent the tubehead from falling out during use.

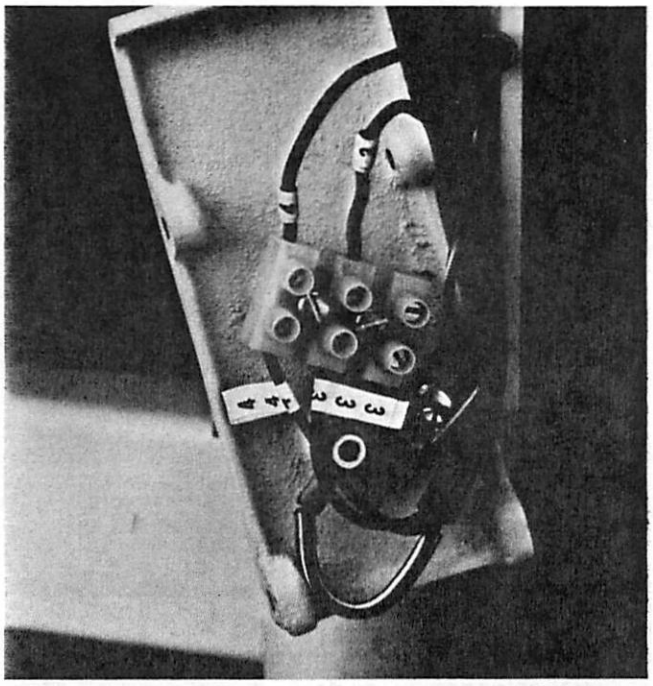


F59829-193

27. Check the tubehead rotation stops by rotating the tubehead through approximately 470 degrees from stop to stop.

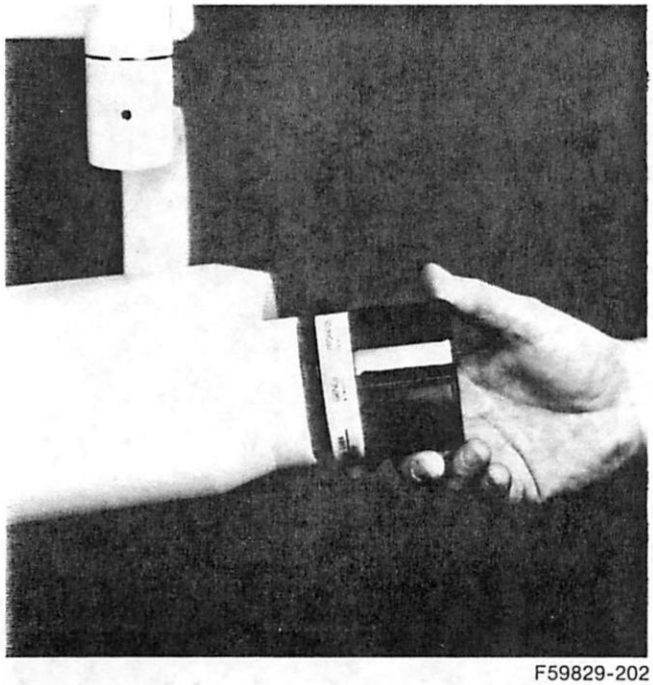
NOTE: Stop MUST be in place to prevent continuous rotation.

28. Connect the four tubehead wires to the terminal strip and ground screw on the tubehead wiring access cover. Wires 3 and 4 connect to wires 3 and 4 on the terminal strip. Both ground wires connect to the ground stud to which the suspension ground wire is already connected.



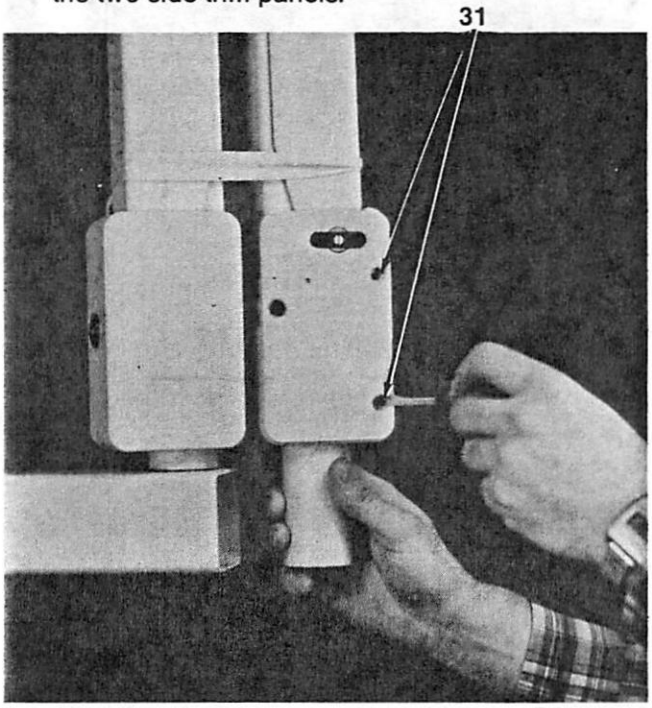
F59829-197

29. Attach cone to the tubehead.

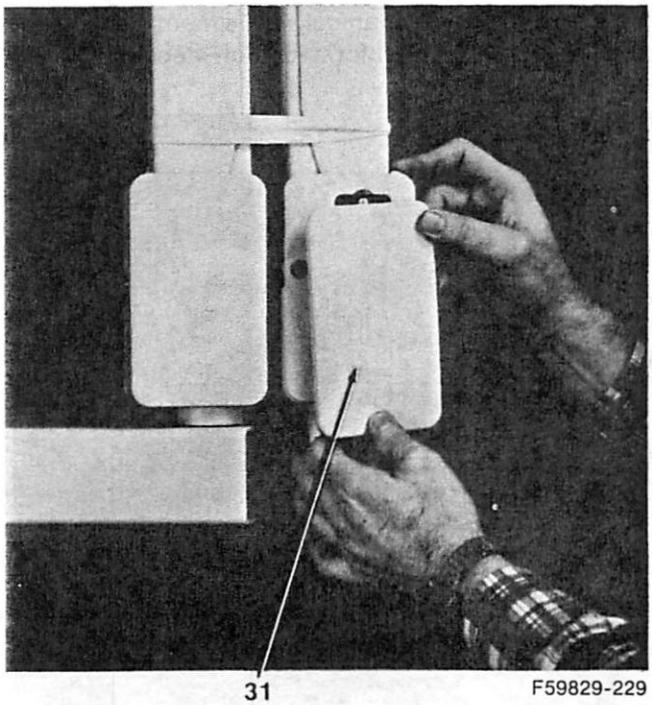


F59829-202

30. Remove the tiewrap from the arm and check the counter balance of the tubehead and for proper movement of the inboard and outboard pantograph arms. If adjustments are required, see Mechanical Adjustment Section.
31. Reinstall the tubehead wiring access cover and the two side trim panels.

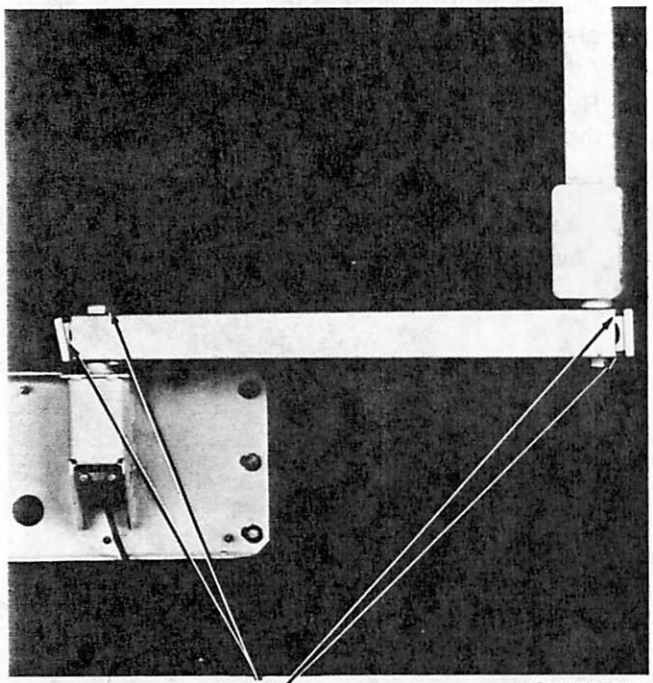


F59829-156



F59829-229

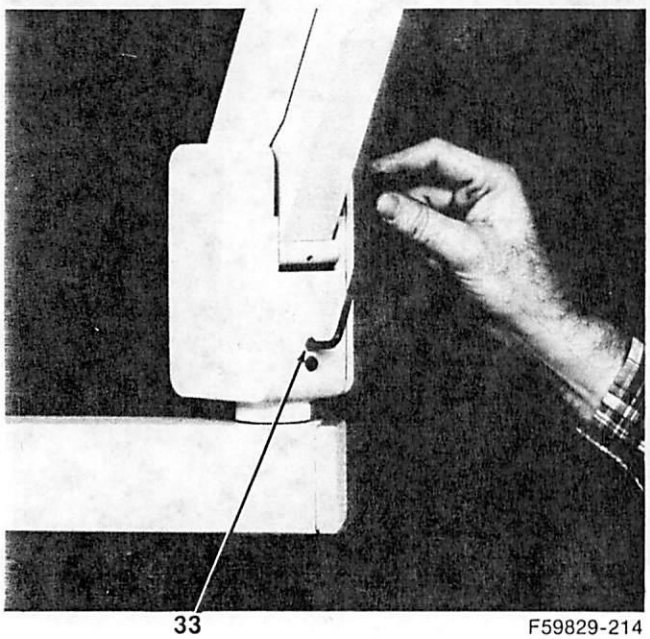
32. Install the two arm end and two pivot post access covers on the horizontal arm.



F59829-209

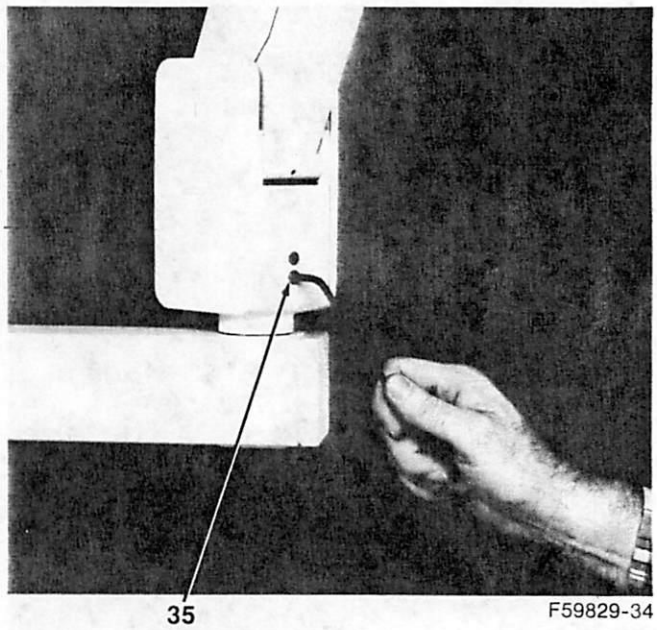
33. Tighten the top set screw, requires a 5/32" allen wrench, located on the lower rear arm casting, then back off 1/2 turn. This screw provides a rotation stop and lift out prevention for the pantograph assembly.

NOTE: Refer to Mechanical Adjustment Section for additional calibration information on steps 33, 35 and 36.



F59829-214

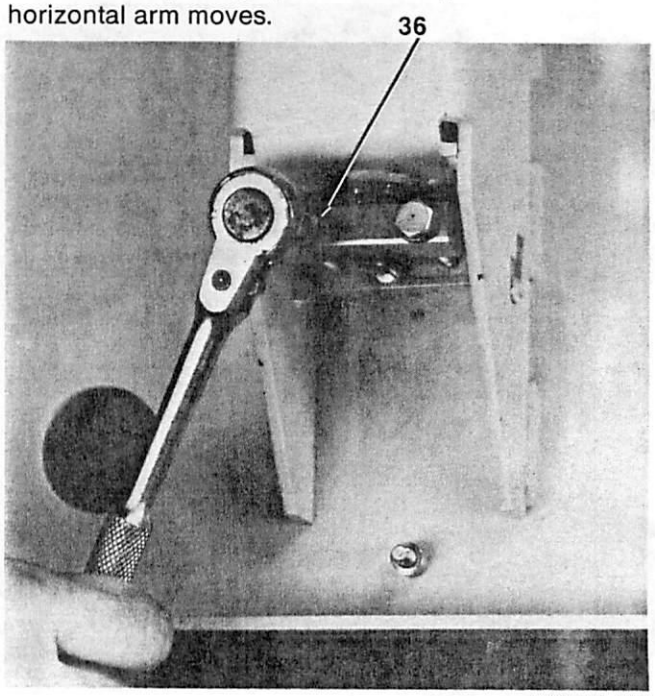
34. Check the pantograph arm for rotation from stop to stop of approximately 240 degrees.
35. Tighten the lower set screw, requires 5/32" allen wrench, located on the lower rear arm casting, until it firms up. This screw adjusts the horizontal brake for the pantograph arm.



F59829-34

36. Tighten the horizontal arm brake, requires a 7/16" wrench or socket, as desired.

NOTE: The horizontal arm brake is normally adjusted so that the pantograph section opens before the horizontal arm moves.



F59829-212

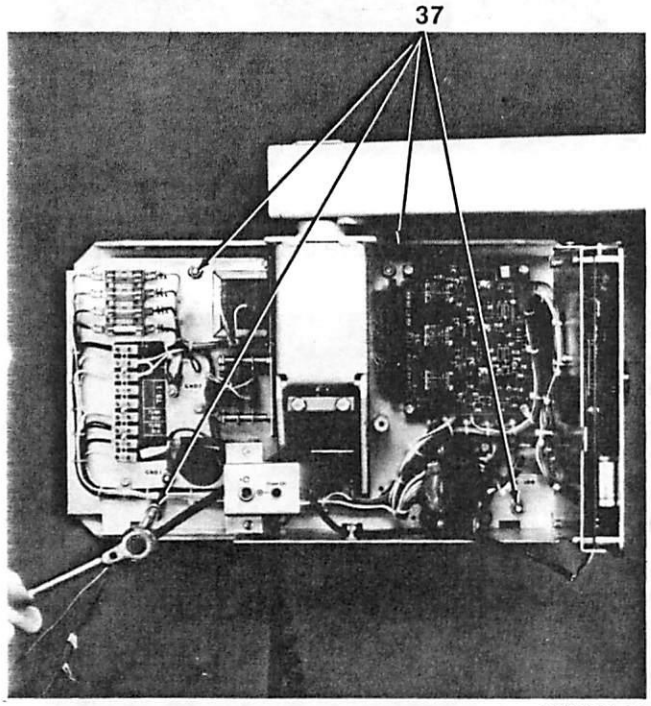
NOTE: If the Master Control is to be installed over a counter where the serial and model number labels would not be visible, they must be removed from the Electrical sub chassis and placed in a location that will be visible after final assembly.

37. Reinstall the electrical sub chassis using the four nuts removed earlier. Before tightening the nuts, the chassis should be shifted to the left as far as possible.

NOTE: If the chassis is to be "hard wired", the power cord should be removed at this time and the conduit wiring connected to the appropriate terminals on TS1 and GND1. If a Remote Station or Remote Exposure Switch is to be part of the system, you should complete the electrical calibration prior to connecting these components.

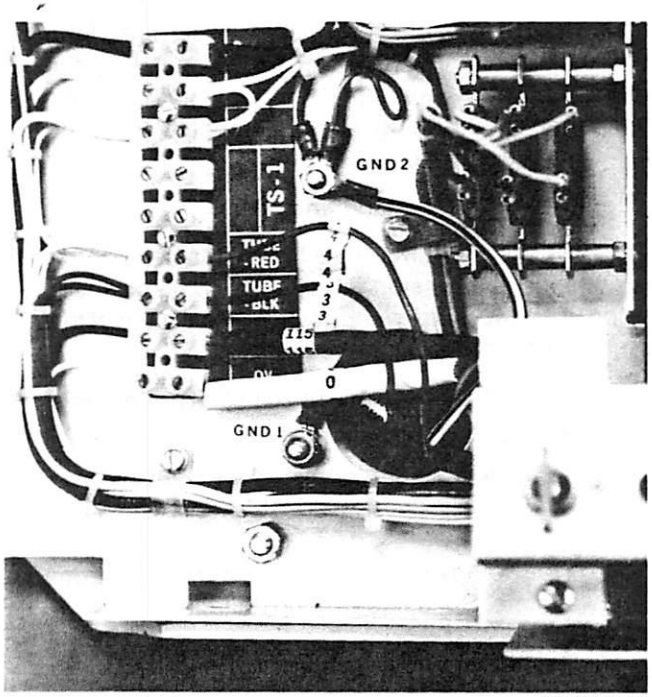
CAUTION

The unit must be properly grounded via a wire to the building ground. Conduit grounding is not sufficient.



F59829-29

38. Connect the suspension arm cable to the appropriate terminals on TS1 and GND2.



F59829-37

The unit is now capable of producing X-rays. Proceed to Section 3, 4, 5, and 6 for electrical calibration, system function checks, certification and final assembly.

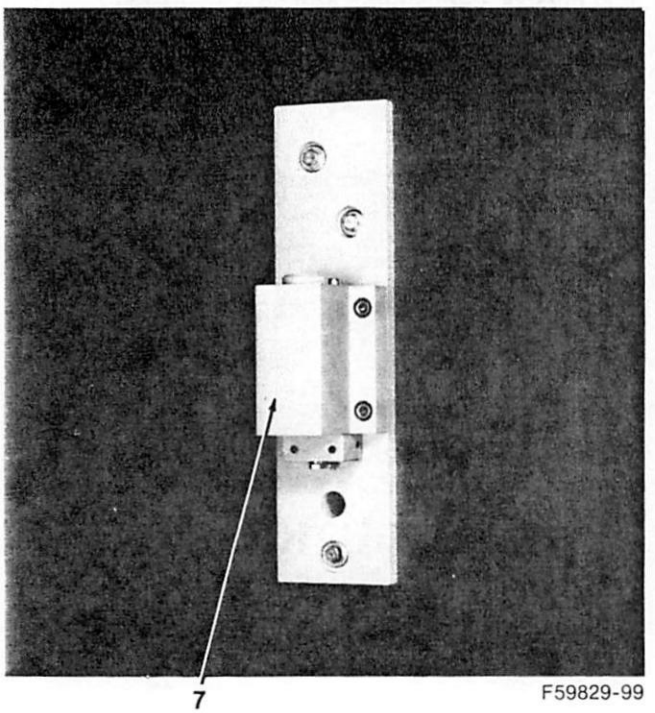
INSTALLATION DIRECTIONS FOR SYSTEM WITH 4X4 OR SPECIAL MOUNTING FIXTURE

The following steps of the installation procedure which begin on page 2-1 of this section along with the modifications noted are applicable for installation of a 4X4 or Special Mounting Fixture, remoted from the wallplate master control.

1. Steps 1 through 4 remain the same.

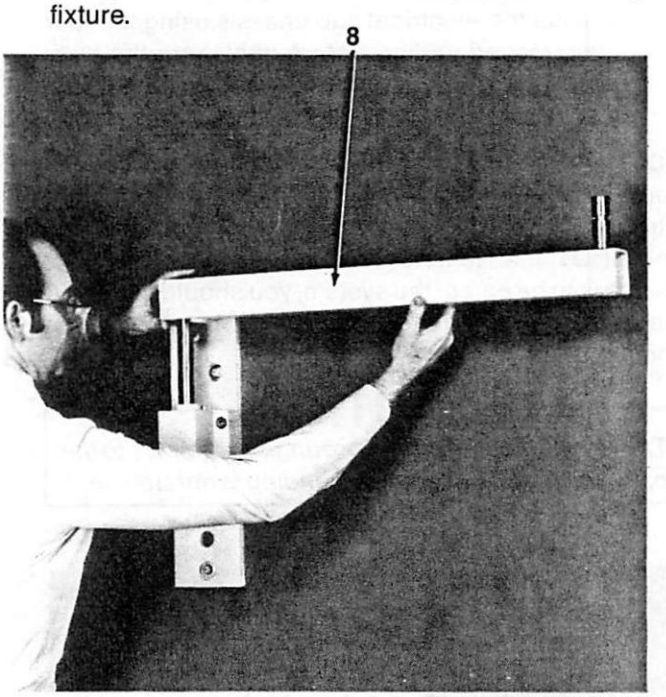
NOTE: Mounting requirements for the Master Control WITHOUT the suspension are: 30 lb. (13.6 kg.) shear load and 90 lb. (40.9 kg.) withdrawal force at each of the four mounting points.

2. Step 5 - Height may be modified to suit preference.
3. Steps 6 through 9 remain the same.
4. Step 10 - Install the remaining 3 corner lag screws loosely. Level the wall plate. Tighten all lag screws securely.
5. Step 11 - Remove the horizontal arm brake from the wallplate. Set aside for reinstallation.
6. Remove the wiring access cover from the 4X4 or special mounting fixture.
7. Install the 4X4 or special mounting fixture using the appropriate mounting hardware. See Preinstallation Section for mounting requirements.



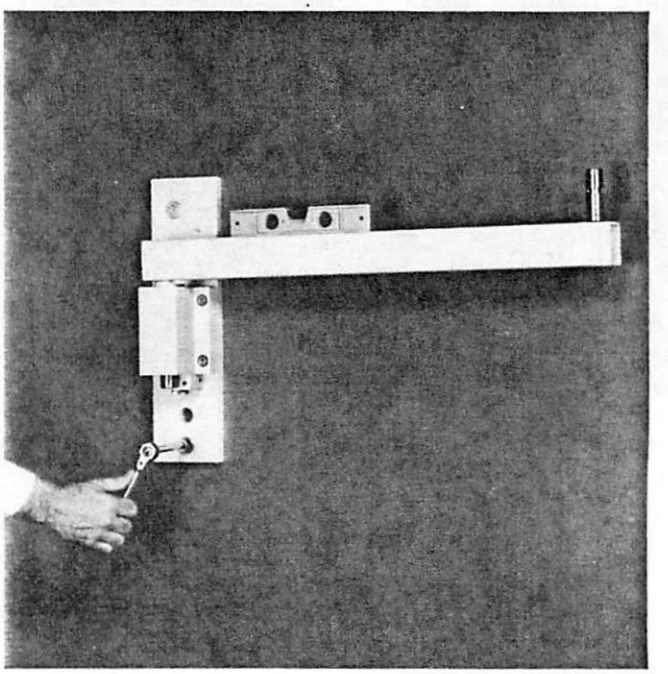
F59829-99

8. Step 12 - Install the horizontal arm with the long pivot post inserted into the 4X4 or special mounting fixture.



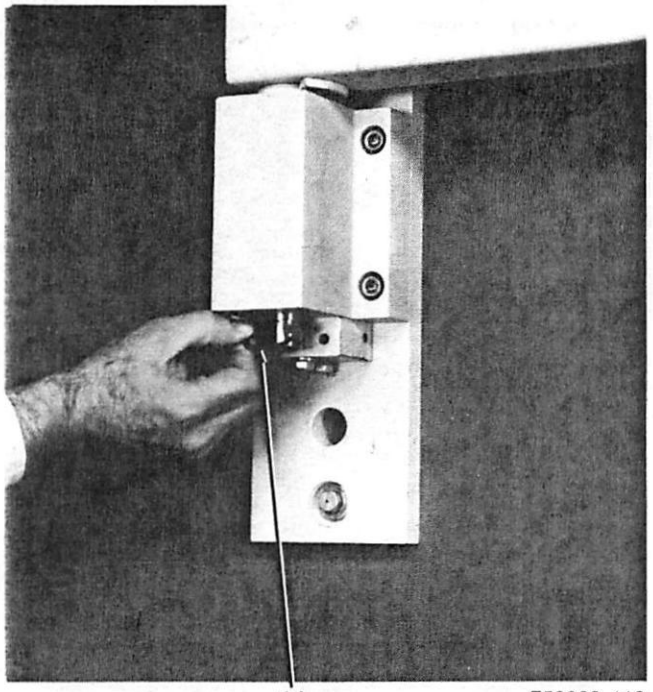
F59829-104

9. Step 13 - Correct the position of the 4X4 or special mounting fixture to achieve the level as described in Step 13, Page 2-4.



F59829-107

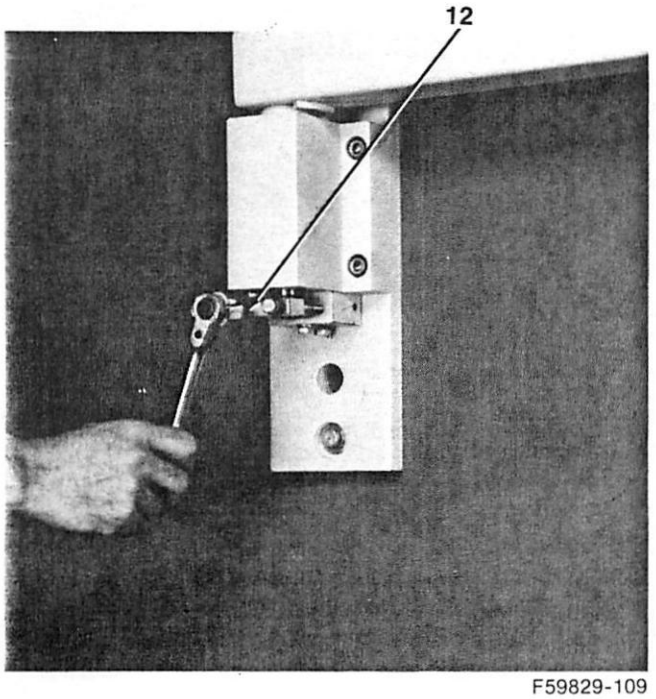
10. Omit Step 14.
11. Install the retaining clip in the slot at the bottom of the horizontal arm pivot shaft.



F59829-110

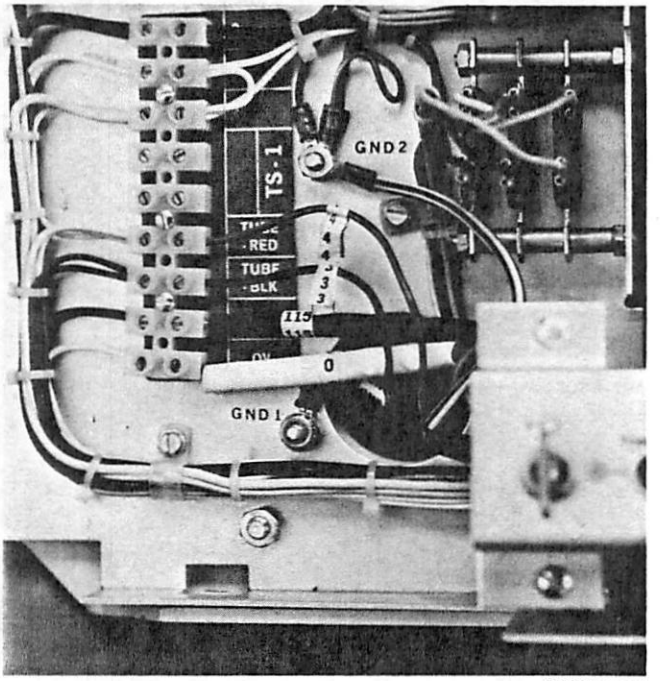
12. Step 16 - Install the horizontal arm brake onto the 4X4 or special mounting fixture.

NOTE: Use brake removed from the master control wallplate.

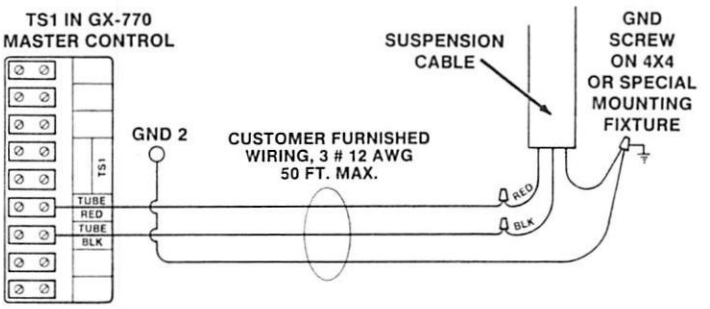


F59829-109

13. Steps 17 through 37 remain the same.
14. Connect the suspension cable to the interconnecting wires and ground screw on the 4X4 or special mounting fixture.



F59829-37

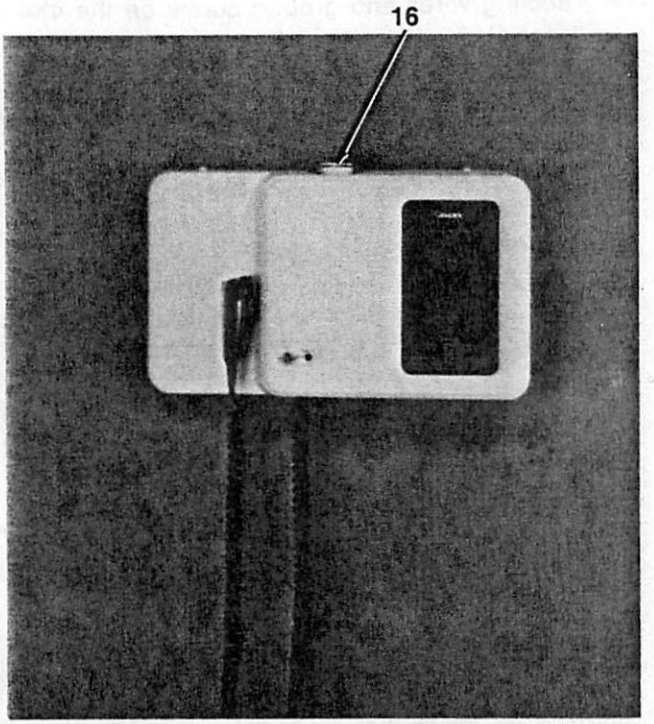


15. Connect the interconnecting wires to the appropriate terminals on TS1 and GND2.

CAUTION

Do not reverse red and black wires in the suspension cable.

16. Install the plug button in place on the wallplate pivot hole.



F59829-119

17. Install the three plug buttons to cover the mounting bolts on the 4X4 mount.
18. Reinstall the 4X4 or special mounting fixture wiring access cover.

SECTION 3
ELECTRICAL CALIBRATION

THE KEY LOCK MUST BE TURNED 90 DEGREES TO ALLOW X-RAY EXPOSURE. NOTE THAT THE KEY CANNOT BE REMOVED WHEN THE SWITCH IS IN THE "ON" POSITION.

WARNING

Radiation will be produced numerous times during the electrical calibration. Therefore a lead plug must be placed over the tubehead port. These plugs are available from GENDEX Corporation. Part No. 100108.

CAUTION

It is recommended that all of the following measurements be recorded by the installer. A separate sheet titled "Product location/Identification Log and Calibration Record is provided for this purpose. One copy should be attached to the owners copy of the form FD2579 and the other to the installers copy.

These calibration procedures must be followed to insure the installation is fully compliant with applicable regulations. If the required measurement values cannot be obtained, contact GENDEX for guidance, and advise the user not to operate the equipment.

INSTRUMENT REQUIREMENTS

The following measuring instruments with required accuracies are needed to insure the GX-770 installation is fully compliant with applicable regulations:

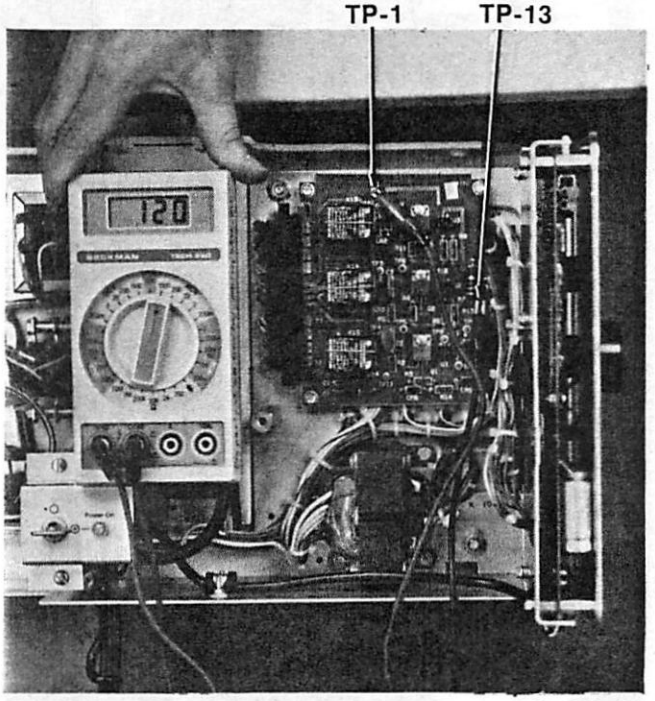
Type of Instrument	Range	Accuracy
AC Voltmeter, Iron Vane or True RMS Digital Meter	0-150 VAC RMS	+/-1.5V
DC Milliameter	0-10 mA DC	+/-0.1mA
DC Voltmeter	0-20V DC	+/-0.02V
Impulse Counter	0-999 Impulses 80-120V RMS 60HZ	+/-0 Impulse

Suggested Instruments:

AC/RMS, DC Voltmeter and DC Milliameter
- Fluke 8030 or 8060 Digital Voltmeter
- Beckman Tech 330 Digital Voltmeter

Impulse Counter
- Kessler-Ellis KT293
- ESD XR201

1. Install a lead plug in the tubehead port.
2. Make sure the Master Control is turned off.
3. Plug in the line cord or turn on the power at the distribution panel.
4. With the Master Control turned off, connect an AC Voltmeter to read 100 to 130 VAC between TP-1 and TP-13 on the Relay Circuit Board.

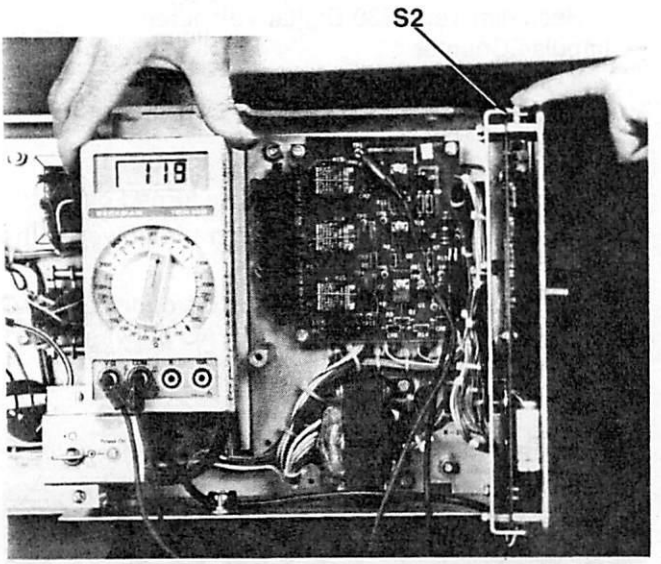


F59829-44

5. Turn on the Master Control and note the voltmeter reading. Record the "No-Load" line voltage on the Calibration Record. This voltage must be between 110 and 130.

6. Set exposure time to 99 impulses. Make an exposure using S2 (Calibration Switch) on the Timer Control Board. Record "Load" voltage on calibration record.

NOTE: The voltage variation, "No-Load" minus "Load" voltage, must not exceed 3 VAC.



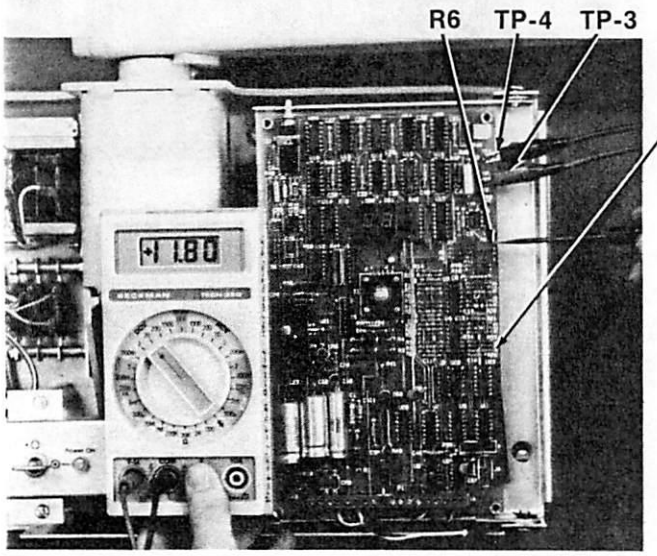
F59829-47

7. Calculate Vcal (load), from step 6, using the following formula:

$$\frac{\text{"Load" Voltage}}{10} = \text{Vcal "Load"}$$

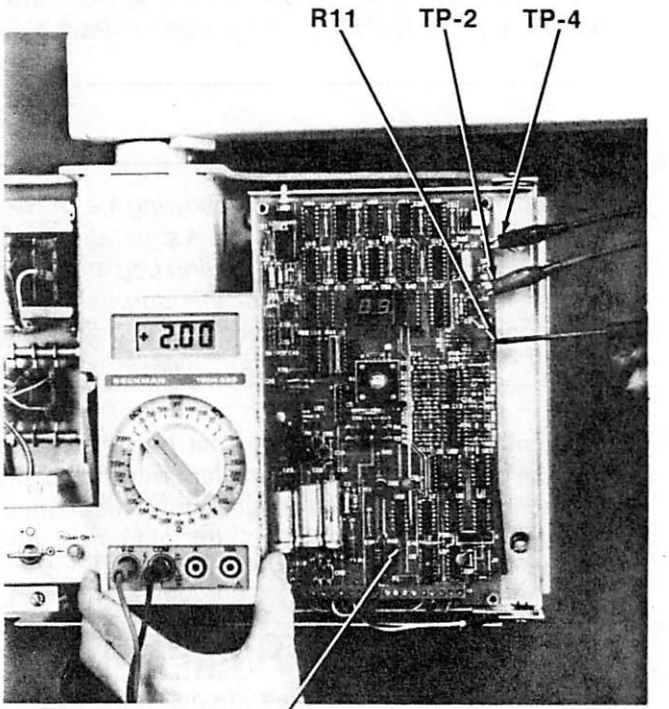
EXAMPLE $\frac{118}{10} = 11.8$

8. With the Master Control turned off, connect a DC Voltmeter to read 10 to 20 VDC between TP-3 (+) and TP-4 (–) on the Timer Control Board.



F59829-19

9. Turn on the Master Control. Note voltmeter reading. Meter reading should be equal to the voltage calculated in step 7, +/–0.05 VDC. If voltage is not correct, adjust R6 on the Timer Control Board to obtain the correct value. Record the final "Vcal Load" reading on the Calibration Record.
10. Turn off Master Control and remove meter leads.
11. With the Master Control turned off, connect a DC Voltmeter, using the same meter and meter scale used in step 8 and 9, between TP-2 (+) and TP-4 (–) on the Timer Control Board.

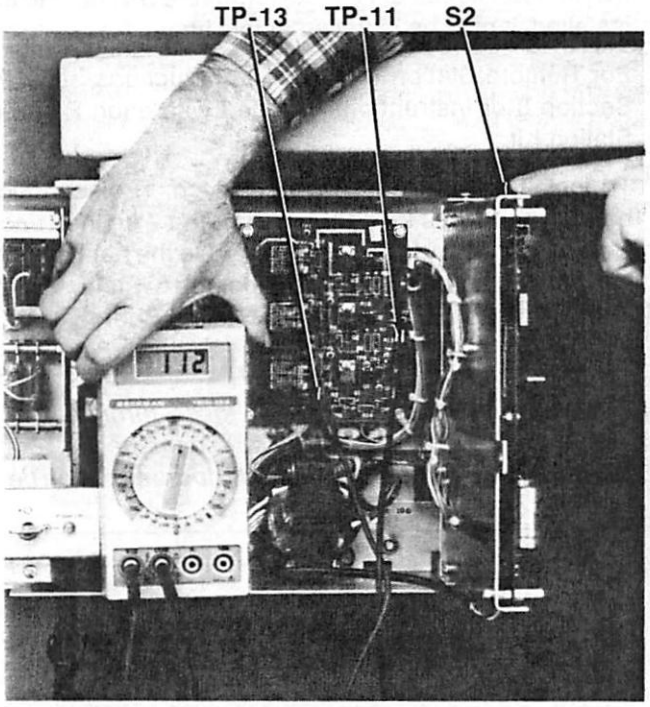


F59829-16

NOTE: Removal of the front (graphic panel) and time selector knob is not required for calibration. Removed in these photos to provide a better view.

12. Turn on the Master Control. Voltmeter reading should be 2.00 +/–0.01 VDC. If not, adjust R11 on the Timer Control Board to obtain 2.00 VDC. Record final "Vref" reading on Calibration Record.
13. Turn off Master Control and remove meter leads.

14. With the Master Control turned off, connect an AC Voltmeter to read 100 to 130 VAC between TP-11 and TP-13 on the Relay Circuit Board.



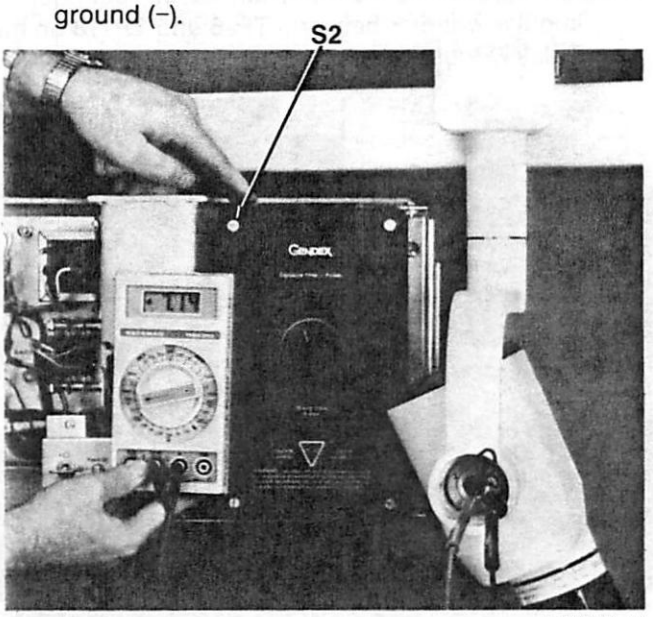
F59829-23

15. Turn on the Master Control. Set exposure time to 99 impulses. Make an exposure using S2 (Calibration Switch) on the Timer Control Board. The "regulated" voltage between TP-11 and TP-13 should be:

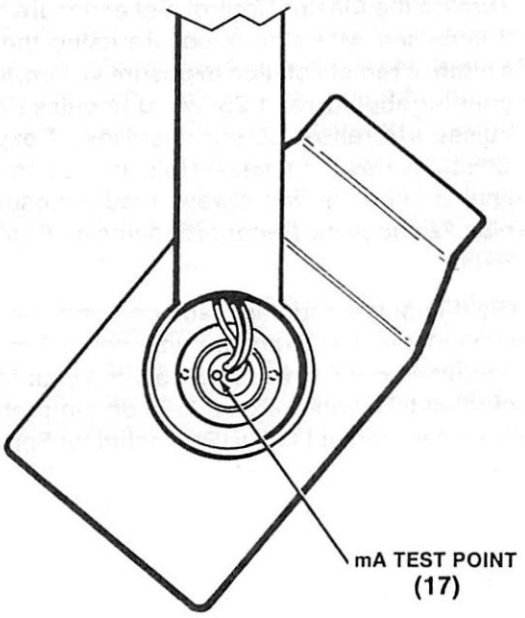
If "No Load" voltage TP-1 to TP-13 is:	TP-11 to TP-13 "Regulated" voltage during exposure should be:
110 to 115 VAC	105 to 115 VAC
115 to 130 VAC	109 to 117 VAC

16. Turn off Master Control and remove meter leads. Record final "regulated" voltage on Calibration Record.

17. With the Master Control turned off, remove the tubehead pivot cover. Connect a DC mA meter to read 5 to 10 mA between the mA test point (+) and ground (–).

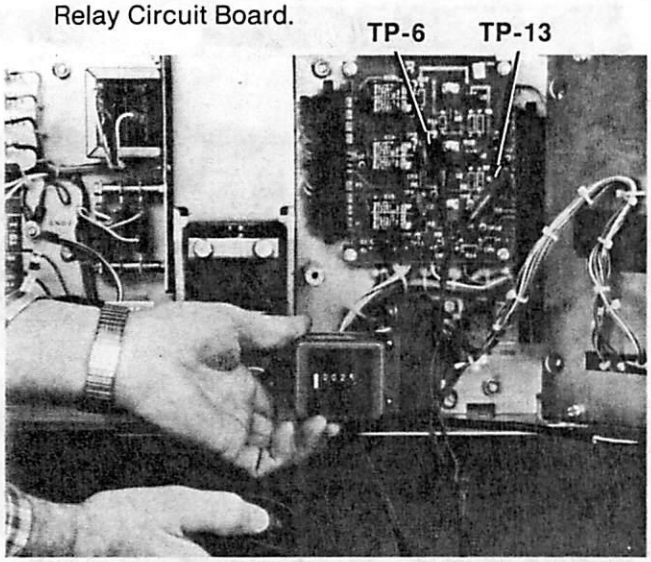


F59829-71



18. Turn on the Master Control. Set exposure time to 99 impulses. Make an exposure using S2 (Calibration Switch) on the Timer Control Board. The mA reading should be 7 +/–1.0mA. If the proper value is not obtained, contact GENDEX Technical Support. Record final reading on the Calibration Record.

19. Turn the Master Control off and remove the meter leads.
20. With the Master Control turned off, connect an impulse counter between TP-6 and TP-13 on the Relay Circuit Board.



F59829-62

21. Turn on the Master Control. Set exposure time for 3 impulses. Make an exposure using the **handswitch** or **remote station exposure switch.** Impulse counter should read 25 +/− 0 impulses (22 impulses of preheat plus 3 impulses of exposure. Check exposure times at 32 and 62 impulses. Impulse counter will always read exposure time plus 22 impulses. Record readings on Calibration Record.

NOTE: If impulse counter reads one impulse higher than calculated, i.e., exposure time set at 3 impulses and impulse counter reads 26, reverse your impulse counter leads. If you are unable to obtain proper exposure times, contact GENDEX Technical Services.

22. Remove the lead plug from the tubehead port and reinstall the cone.

If a Remote Station or Remote Exposure Switch is to be installed, it may be installed at this time.

For Remote Station installation instructions, refer to Section 8 or instructions shipped with each Remote Station Kit.

To install a Remote Exposure Switch, 1) disconnect handswitch wires from terminals 6 and 7 on the Timer Control Board and completely remove the handswitch and cord, 2) connect Remote Exposure Switch wires to terminals 6 and 7 on the Timer Control Board.

CAUTION

Use of any switch other than those furnished or recommended by GENDEX could damage the GX-770. In no case should a "lighted" doorbell button be used.

SECTION 4
SYSTEM FUNCTION CHECKS

The following must be performed to complete the installation of the GX-770. These are also to be performed as part of the PERIODIC MAINTENANCE, at 12 month intervals, Failure to perform these checks may result in an installation that does not comply with U.S. Radiation Performance Standard CFR Subchapter J.

IMPORTANT

If the GX-770 System does not perform the functions as follows, see the Troubleshooting Section of this manual or contact GENDEX Technical Support. Advise the owner that the system is NOT TO BE USED.

1. Complete the Electrical Calibration (Section 3) before proceeding.
2. Labels — Insure that all certified components bear labels that include model and serial numbers, date of manufacture, and a statement of certification. This is required on:

   Master Control ..... Model #46-404600G1
   Tubehead ..... Model #46-404650G1
   Remote Station ..... Model #46-404725G1
   12 Inch Focal
   Length Cone ..... Model #46-404653G1
   8 Inch Focal
   Length Cone ..... Model #46-404653G2

   The suspension is Model #46-404770G1 and is not required to be certified.
3. Tubehead — Check for oil leaks or other evidence that could indicate internal damage. Replace tubehead if necessary.
4. Check that the aluminum filter is in place inside the tubehead port and shows no sign of damage.
5. Cone — Check that the cone is undamaged, properly installed, and that the distance from the surface of the tubehead port to the distal end of the cone is at least 2.5 in. (6.5 cm).
6. Handswitch — Inspect the handswitch housing and coiled cord for damage or wear. Replace if the housing is cracked or the cord is frayed or cracked.
7. Mounting — Be sure the Wall Support, 4X4 Mount, or the Special Mounting Fixture is securely mounted to the wall or other supporting structure.
8. Key Lock Switch — Turn key to "OFF" position and remove the key. Press exposure switch to verify that an exposure can not be made. Insert the key and turn the key lock to the "ON" position and verify that an exposure can be made.
9. Power On Lamp — Turn key lock to the "ON" position. Verify that the Power On Lamp lights. If a Remote Station is connected, verify that the Exposure Time Readout is operating.
10. Indication of Technic Factors — Verify that the "70 kVp -7mA" is legible on the front panel of the Master Control or the Remote Station. Also check the "Warning" statement.
11. Premature Termination — Select an exposure time of 99 impulses. Make an exposure, but release the exposure button before the exposure terminates automatically. The exposure should terminate as soon as the exposure switch is released.
12. Exposure Indicators — Make several additional exposures of less than 30 impulses and verify the operation of the "X-RAY" lamp at the Master Control or the Remote Station. If there is a Remote Station, verify that the audible signal can be heard at the Remote Station location.
13. X-ray Beam Size — Expose several occlusal film packs (taped together) or a panoramic cassette, placed square just at the end of the cone. Process the film and verify that the resulting image is containable in a 2.5 in. (6.5 cm) circle.
14. Suspension — Should extend and retract smoothly and quietly. Should not drift out from the wall or to either side. (see Mechanical Adjustment Section).
15. Information for User — After completing all the previous checks, be sure to turn the GX-770 User Manual over to the owner/user.

NOTE: All required information to be furnished to the user is included in the User Manual. Providing the user with the Installation/Maintenance Manual is also recommended.

SECTION 5
CERTIFICATION

CERTIFICATION RESPONSIBILITY

The GX-770 is certified to comply with provisions of the United States Government Radiation Performance Standards when assembled, calibrated and checked according to the instructions given in this publication.

It is therefore the responsibility of the installer to:

1. Assemble the system according to previous Sections.
2. Perform the Electrical Calibration and System Function Checks.
3. Complete and distribute copies of the United States Form FD2579 for installations subject to the United States jurisdiction (see example on page 5-2).
4. Maintain the records of equipment location according to the applicable provisions of the United States law. See Product Location/Identification Log and Calibration Record.

PRODUCT LOCATOR CARDS

A preprinted "IBM" card is furnished with each serialized component, as part of the GENDEX Product Locator System and for the extended tubehead warranty. Each should be completed by the installer and returned to GENDEX.

Product Locator cards are provided for the following serialized GX-770 components:

Component	Model No.	Certified*
Tubehead	46-404650G1	Yes
Master Control	46-404600G1	Yes
Remote Station	46-404725G1	Yes
12 Inch Cone	46-404653G1	Yes
8 Inch Cone	46-404653G2	Yes
Suspension	46-404770G1	No

*Certified components must be listed on the FD2579 and/or a separate list of must be maintained by the installer. See Product Location/Identification Log and Calibration Record.

GENDEX Corporation | PRODUCT LOCATOR FILE
P.O. BOX 21004
MILWAUKEE, WI 53221

LOT	DESCRIPTION	MODEL	SERIAL	
800	GX-770 CONT DOM	46-404600G1	800101	FP

INSTALLATION

NAME A.B. Rankin, D.M.D.	NAME J. P. Smith DATE 4/25/84
ADDRESS 515 West Edgerton Avenue	COMPANY Progressive Dental Equip. Co.
	ADDRESS 1204 E. Main Street
CITY Waukesha STATE WI ZIP 53207	CITY Waukesha STATE WI ZIP 53151
TELEPHONE NO. AREA 414 555-4911	TELEPHONE NO. AREA 414 555-1194

CERTIFICATION FORM

Upon completion of installation, system/function checks and calibration, the certification form (FD2579) is to be completed and distributed according to provisions of U.S. Law.

NOTE: Even though the new FD2579 form shown below does not request serial and model numbers for all certified components, the installer remains responsible for location data on ALL certified components. See Product Location/Identification Log and Calibration Record.

COMPLETED EXAMPLE

FOR FDA USE ONLY	DEPARTMENT OF HEALTH AND HUMAN SERVICES PUBLIC HEALTH SERVICE FOOD AND DRUG ADMINISTRATION REPORT OF ASSEMBLY OF A DIAGNOSTIC X-RAY SYSTEM	Form Approved: OMB No. 0910-0023 Use of this form is prohibited after December 31, 1984. C 114784

1. EQUIPMENT LOCATION

a. Name of Hospital, Doctor or office where installed: A.D. Goodrich, D.M.D.
b. Street Address: 515 West Edgerton Avenue
c. City: Milwaukee
d. State: WI
e. Zip Code: 53207
f. Telephone Number: 414-555-4911

2. ASSEMBLER INFORMATION

a. Company Name: Progressive Dental Equipment Co.
b. Street Address: 1204 Main Street
c. City: Waukesha
d. State: WI
e. Zip Code: 53151
f. Telephone Number: 414-555-1194

3. GENERAL INFORMATION

a. This report is for assembly of certified components which are *(Check appropriate box (es))*
- [X] A complete x-ray system *(Includes x-ray control, tube housing assembly, beam limiting device, and x-ray generator)*
- [ ] A replacement of component(s) in the existing system
- [ ] An addition to the existing system

b. Intended use(s) *(Check applicable box(es))*
- [ ] General Purpose Radiography
- [ ] General Purpose Fluoroscopy
- [ ] Tomography *(Other than CT)*
- [ ] Angiography
- [ ] Podiatry
- [ ] Urology
- [ ] Mammography
- [ ] Chest
- [ ] Chiropractic
- [ ] CT Head Scanner
- [ ] CT Whole Body Scanner
- [ ] Head-Neck *(Medical)*
- [X] Dental-Intraoral
- [ ] Dental-Cephalometric
- [ ] Dental-Panoramic
- [ ] Radiation Therapy Simulator
- [ ] Any Other *(Specify in comments)*

c. The X-ray System is *(check one)*: [X] Stationary [ ] Mobile
d. The Master Control is in Room: Room 2
e. Date of Assembly: 04 (mo.) 02 (day) 84 (yr.)

4. COMPONENT INFORMATION *(If additional space is needed for this section use another form, replacing the preprinted number with this Form Number and complete items 1, 4 and 5 only)*

a. The master control is: [X] A new installation [ ] Existing *(Certified)* [ ] Existing *(Non-certified)*

b. Control Manufacturer	c. Control Model Number	d. Control Serial Number
GENDEX	46-404600G1	800 103 FP

Complete the following information for the certified components listed below which you installed. For beam limiting devices and tables enter the manufacturer and model number in the indicated spaces. For other certified components, enter in the appropriate blocks how many of each you installed in this system.

e. Selected Components			f. Other Certified Components *(Enter number of each installed in appropriate blocks)*	
Beam Limiting Device	Manufacturer: GENDEX	Model Number: 46-404653G1*	[ ] X-ray Control	[ ] Cradle
	Manufacturer: GENDEX	Model Number: 46-404653G2**	[ ] High Voltage Generator	[ ] Film Changer
	Manufacturer:	Model Number:	[ ] Vertical Cassette Holder	[ ] Image Intensifier
Tables	Manufacturer:	Model Number:	[ ] Tube Housing Assembly *(Medical)*	[ ] Spot Film Device
	Manufacturer:	Model Number:	[X] Dental Tube Head	[ ] Other *(Specify)*

5. ASSEMBLER CERTIFICATION

I affirm that all certified components assembled or installed by me for which this report is being made, were adjusted and tested by me according to the instructions provided by the manufacturer(s), were of the type required by the diagnostic x-ray performance standard (21 CFR Part 1020), were not modified to adversely affect performance, and were installed in accordance with provisions of 21 CFR Part 1020. I also affirm that all instruction manuals and other information required by 21 CFR Part 1020 for this assembly have been furnished to the purchaser and within 15 days from the date of assembly, each copy of this report will be distributed as indicated at the bottom of each copy.

a. Printed Name	b. Signature	c. Date
J.P. Smith	J. P. Smith	4/3/84

6. COMMENTS

*12 inch focal length cone
**8 inch focal length cone

FORM FDA 2579 (8/82)

White Copy - FDA, HFX-490, 5600 Fishers Lane, Rockville, MD 20857

SECTION 6
FINAL ASSEMBLY

Final assembly of the unit should not take place until the electrical calibration, installation of a Remote Station or Remote Exposure Switch (if used) and the System Function Checks have been completed.

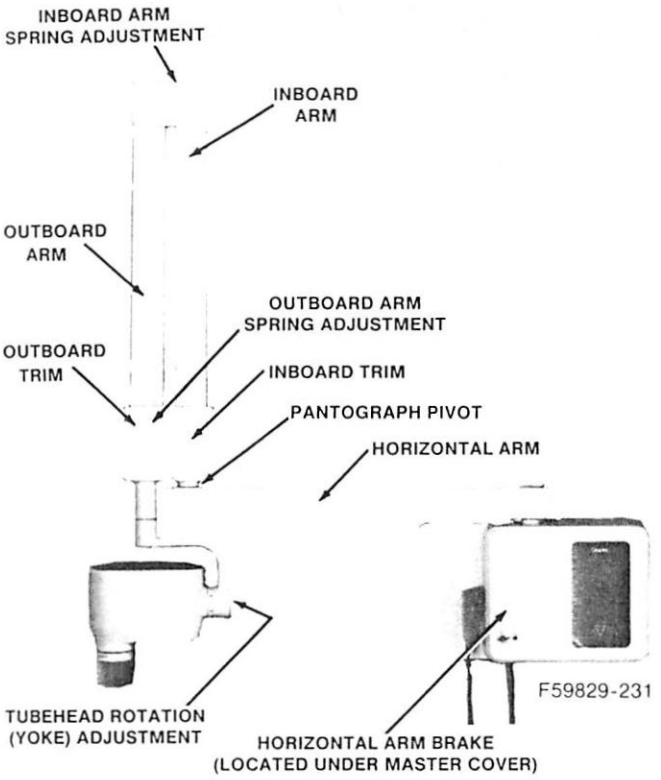
1. Check to insure that the tubehead pivot cover has been reinstalled.
2. Check to insure that all suspension trim covers and plug buttons are installed.
3. Check all wiring terminations including those to a Remote Station or a Remote Exposure Switch for shorts or loose connections.
4. Install the screw to hold the Timer Control Board chassis in place.
5. Install the Master Control cover in place using the four screws removed in Section 2.
6. If a Remote Station is installed, check to insure the assembly is complete and the front cover (bezel) is installed.
7. Be sure the cone is properly installed and the lead plug is removed.
8. Turn the unit "ON" and check for proper operation.

SECTION 7
MECHANICAL ADJUSTMENTS

CAUTION

The positioning of the tubehead and suspension should always be smooth and quiet. If it is difficult or noisy, there might be a mechanical malfunction that could lead to an injury to the patient or operator. If the malfunction cannot be located and corrected, replacement of the suspension is recommended.

GX-770 SUSPENSION



OUTBOARD ARM BALANCE

The outboard arm spring tension and friction adjustments are used to counterbalance the tubehead, trim and cone. Adjustments may be required at installation, after wear due to use or when switching between 8 and 12 inch cones. To check: Bring the inboard arm to the vertical position and move the tubehead through its entire range of vertical travel. The tubehead must maintain position when released. If movement occurs, proceed as follows:

1. If the tubehead has a constant drift, up or down, through its entire range:
   a. Remove the outboard trim covers and the tubehead wiring access cover.
   b. Raise the tubehead until the outboard arm spring assembly adjustment nut can be reached, with the special socket shipped with the arm, through the tubehead wiring access.
   c. Adjust the spring assembly as required. Turn the nut clockwise to increase spring tension.
2. If the tubehead has drift, up or down, but only at isolated places during travel through its range:
   a. Remove the outboard trim covers.
   b. Tighten the friction adjustment screws, one on each side, as required.

INBOARD ARM BALANCE

The inboard arm spring tension and friction adjustments are used to counterbalance the outboard arm, inboard arm, trim, tubehead, and cone. Adjustments may be required at installation, after wear due to use or when switching between 8 and 12 inch cones.

To check: Use the tubehead to move the inboard arm through its entire range of vertical travel. The arm must maintain its position when released. If movement occurs, proceed as follows:

1. If arm has a constant drift, up or down, through its entire range:
   a. Remove the inboard spring adjustment access plug on the top trim.
   b. Raise or lower the inboard arm until the spring assembly adjustment nut can be reached with the special socket shipped with the arm.
   c. Adjust the spring assembly as required. Turn the nut clockwise to increase spring tension.
2. If the inboard arm has drift, up or down, but only in isolated places during travel through its range:
   a. Remove the top trim panel on the left side as you face the unit.
   b. Tighten the friction adjustment, hex screws, as required.

PANTOGRAPH PIVOT BRAKE

The pantograph pivot friction brake should be set to allow smooth easy pivot of the suspension and yet prevent horizontal drift of the pantograph on the horizontal arm. This adjustment along with the horizontal arm pivot brake may also be used to produce a desired sequence of movement between the pantograph and the horizontal arm pivot.

NOTE: Neither adjustment is designed to overcome drift created by an "out of level" wall plate.

If adjustment is required:

1. Tighten or loosen the lower set screw on the inside of the pantograph pivot.

HORIZONTAL ARM PIVOT BRAKE

The horizontal arm pivot brake should be set to allow smooth easy pivot of the suspension and yet prevent horizontal drift of the arm. This adjustment along with the pantograph pivot brake may also be used to produce a desired sequence of movement between the pantograph and the horizontal arm pivot.

NOTE: Neither adjustment is designed to overcome drift created by an "out of level" wall plate.

If adjustment is required:

1. Unplug line cord or turn off power at distribution panel.
2. Remove Master Control or 4X4/Special fixture cover.
3. Adjust the horizontal arm pivot brake as required. Adjust both bolts an equal amount to achieve the desired effect.

TUBEHEAD ROTATION (In the yoke)

The tubehead rotation adjustment is used to assure that the tubehead maintains its position around the horizontal axis provided by the yoke while remaining easy to rotate and position. Adjustment may be required at installation, after wear due to use, or when switching between 8 and 12 inch cones. To check: Rotate the tubehead through its 270 degree travel around the yoke axis. It should move freely. Release the tubehead at various positions around its arc. It should maintain its position.

If the tubehead is tight during rotation or will not maintain its position, proceed as follows:

1. Remove the yoke end cap.
2. Adjust the shaft lock ring as required. Tightening the lock ring increases the friction on the movement. A pair of needle-nose pliers may be used to turn the lock ring.

SECTION 8
REMOTE STATION INSTALLATION INSTRUCTIONS

NOTE: Electrical connections of the Remote Station should not be attempted until the Electrical Calibration (Section 3) has been completed. However Steps 1 through 9 may be completed prior to that time.

GENERAL

During installation of the Remote Station, the Timer Control Board will be removed from the wallplate Master Control and installed in the Remote Station chassis. A new graphic panel, shipped with the Remote Station kit, will be installed in place of the Timer Control Board graphic shipped with the GX-770 Master unit.

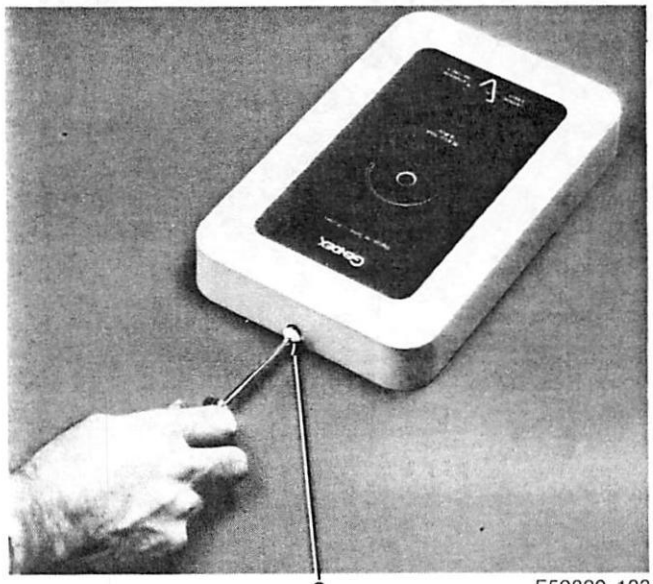
1. Determine the location of the Remote Station. The unit may be mounted at any height over a range of 48 to 60 inches from the bottom of the remote to the floor. If concealed wiring is used for the remote cable, note the cable entry hole is located 3-3/8 inches from the bottom of the remote wallplate and centered left to right. See Preinstallation Section or the GX-770 template for additional details.
2. If the Remote Station cable is to be concealed, it should be routed at this time.

CAUTION

The remote station cable must not be routed through conduit with 120 volt conductors. A short insulating jacket is supplied to cover the remote cable from the junction box to the handswitch cable clamp in the Master Control.

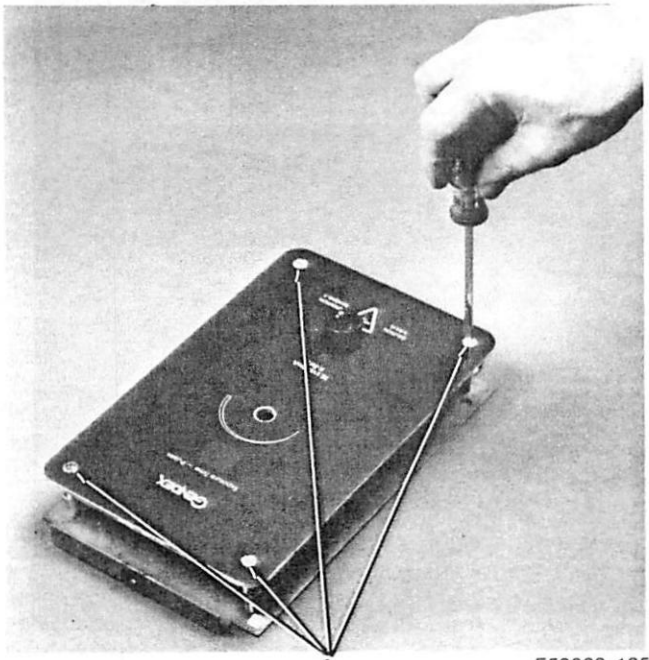
NOTE: Individual wires on both ends of the remote cable have been tinned for ease of installation. If it is necessary to cut the cable, do so on the wallplate end and only after the Remote Station end has been terminated.

3. Remove the three screws, one in the top and two in the bottom, which hold the Remote Station cover in place. Remove the cover and set aside in a safe place.



F59829-123

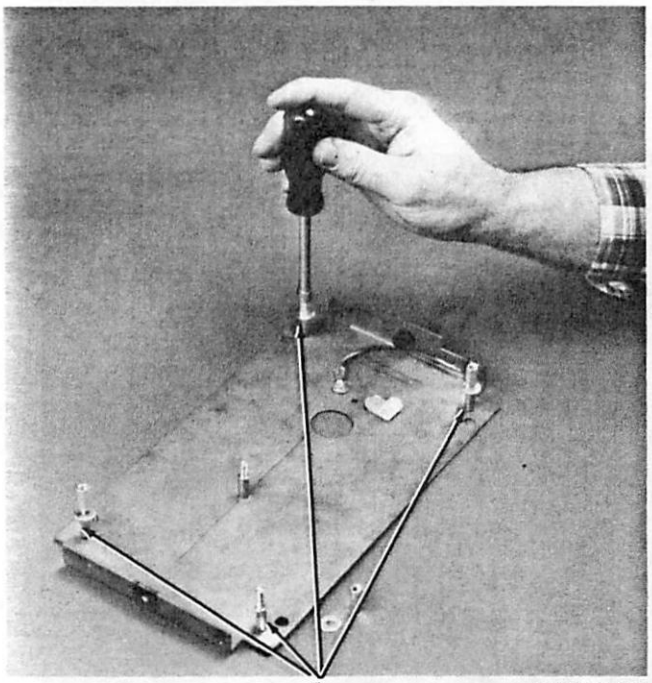
4. Remove the four screws which hold the graphic panel in place. Remove the graphic panel and set aside in a safe place.



F59829-125

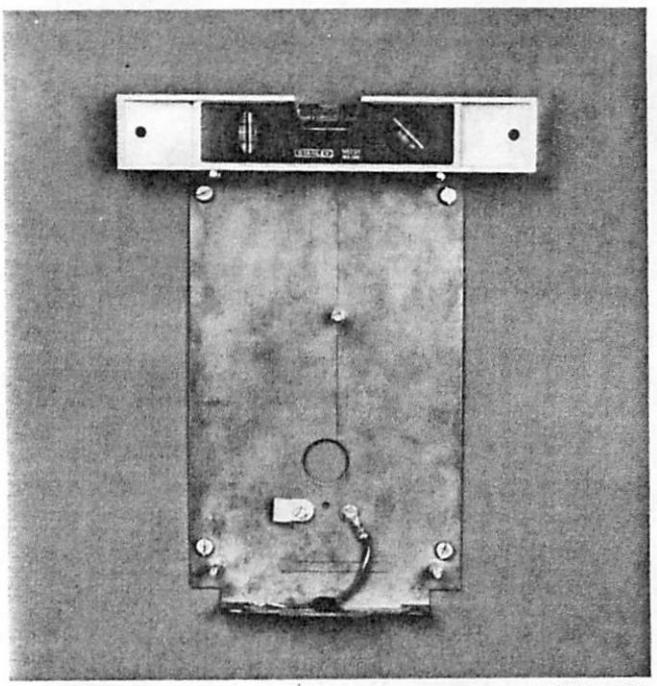
5. Remove the top spacer and washer from each of the four spacer studs.

NOTE: The washers will be used in Step 23.



5 F59829-131

6. Install the Remote Station wallplate, using the appropriate hardware, with the cable entry hole at the bottom.

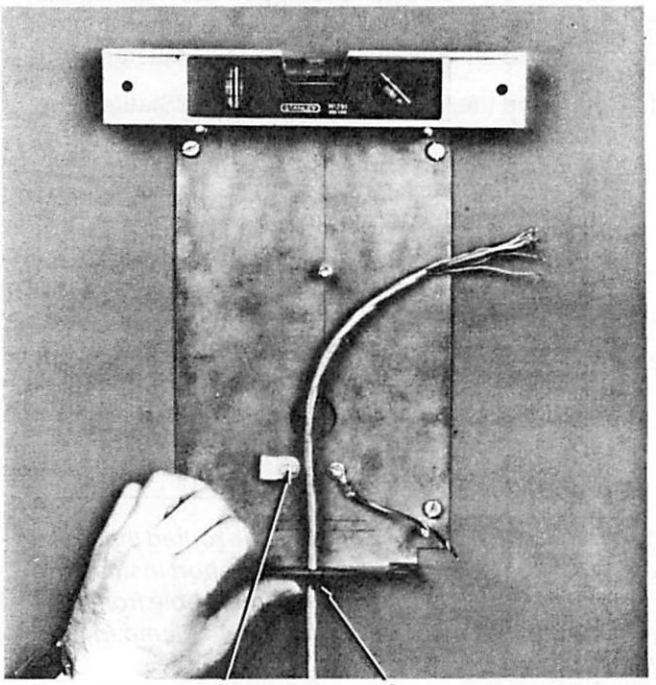


F59829-181

7. If the cable is to be surface mounted, it should be routed at this time.

FOR SURFACE MOUNTING OF THE REMOTE CABLE

8. Insert the end of the cable to be attached to the remote through the furnished grommet, large diameter end of the grommet goes onto the cable first. Insert the end of the cable through the hole in the bottom of the remote wallplate. Position the grommet so that approximately 11 inches of the cable will be inside the wallplate when the grommet is installed. Snap the grommet in place at this time.

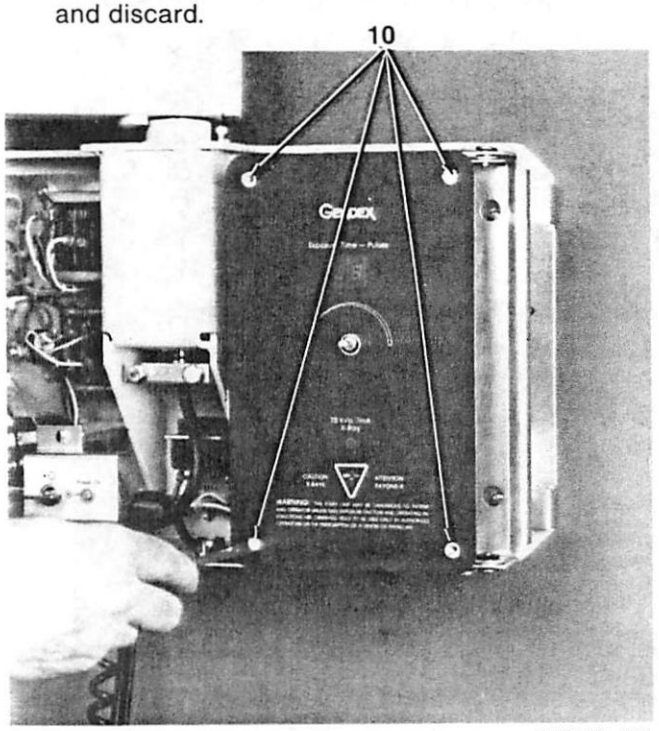


9 8 F59829-186

9. Remove the cable clamp from the remote wallplate. Attach the clamp to the cable and reinstall on the wallplate.

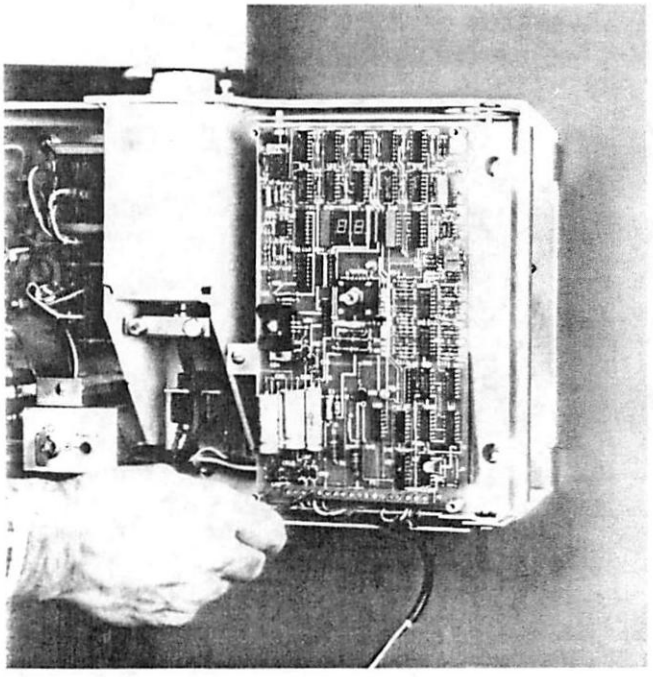
At this time the Electrical Calibration (Section 3) must be complete. Once the Electrical Calibration is complete, you may proceed.

10. Remove the Master Control time selector knob. Remove the four screws which hold the Master Control graphics panel in place. Remove the panel and discard.



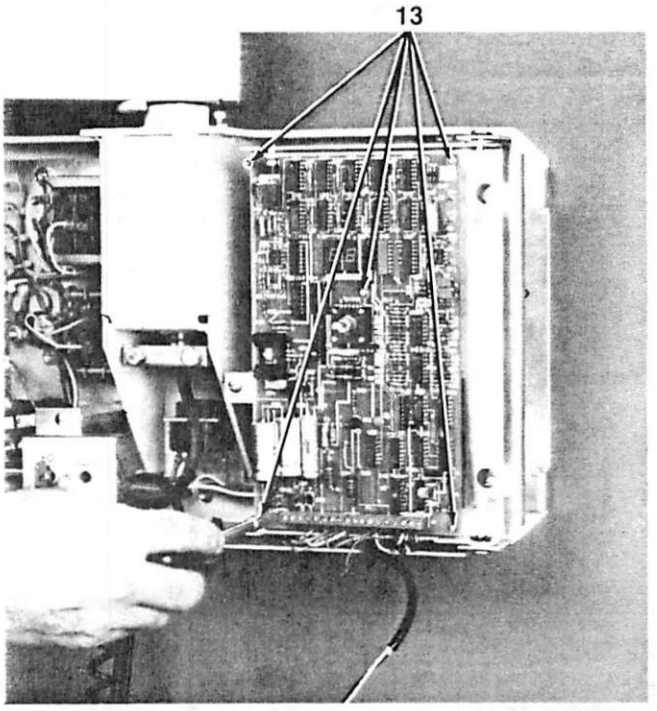
F59829-186

11. Disconnect all wires, including the handswitch, from the Timer Control Board terminal strip.



F59829-191

12. Completely remove the handswitch and coiled cord assembly from the unit and set aside. Do not remove the handswitch cable clamp. It will be reused in step 20. The handswitch will not be used in this system configuration.
13. Remove the four spacers and nut which hold the Timer Control Board in place. Lift the board off of the studs.

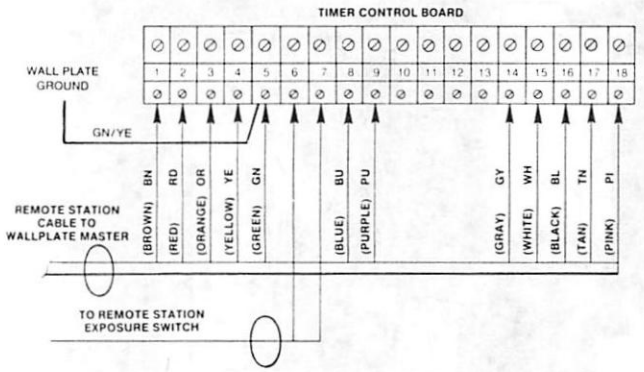


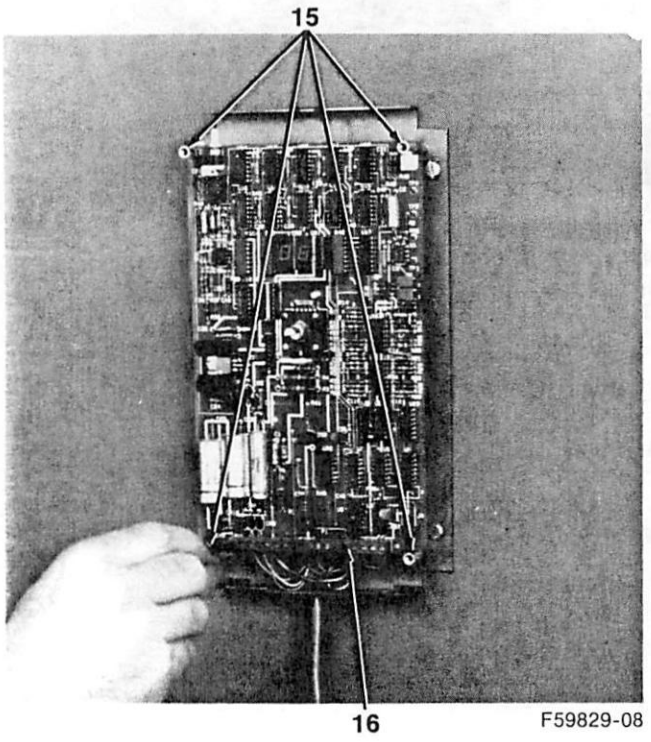
F59829-74

14. Remove the insulating paper installed in the top slot of the Timer Control Board mounting plate.

15. Install the Timer Control Board in place on the Remote Station wall plate, using the four spacers removed in Step 5 and nut removed in Step 13.
16. Connect the remote cable to the terminal strip on the Timer Control Board. Color codes are shown on the board below the terminal strip. A diagram is also shown below.

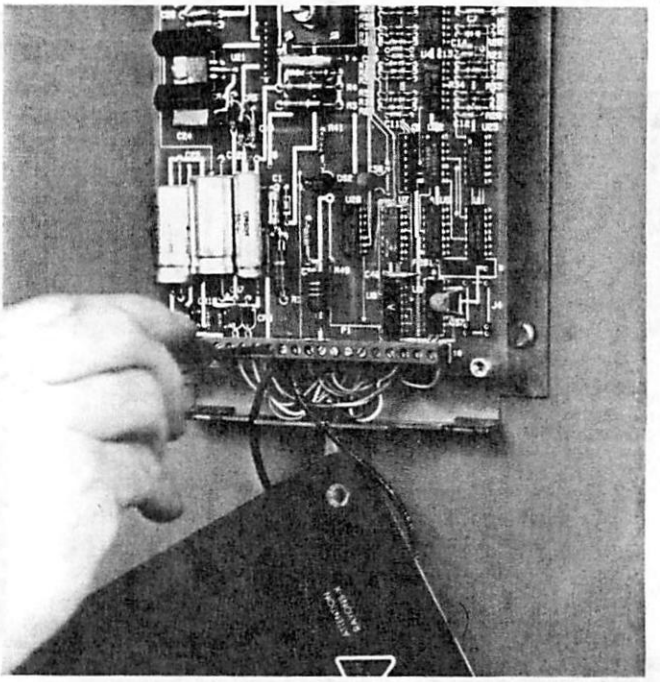
NOTE: Wallplate ground wire, yellow/green, also connects to terminal 5.





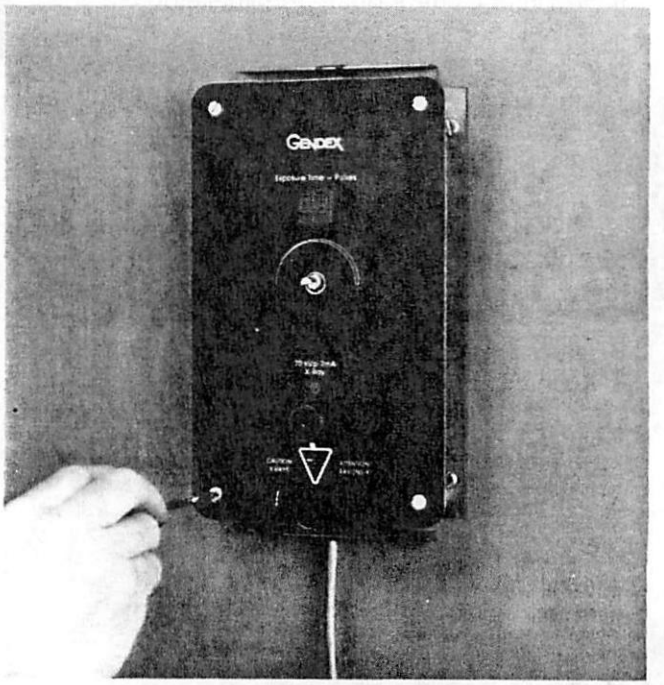
F59829-08

17. Connect the exposure switch installed in the Remote Station graphic panel, wires to terminals 6 and 7 on the Timer Control Board terminal strip.



F59829-11

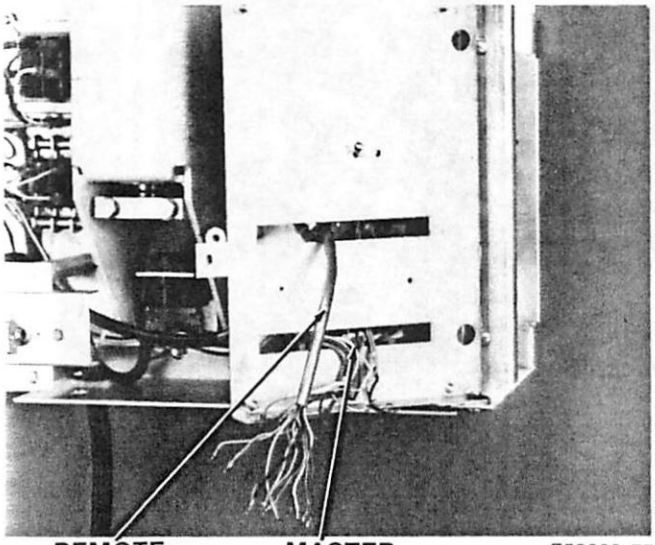
18. Install the graphic panel to the Remote Station standoffs using the screws removed in Step 4.



F59829-172

19. Install the time selector knob.

20. Route the remote cable into the Master Control and to the Timer Control Board mounting plate. Insert the end of the cable through the top slot in the mounting plate. Leave approximately 10 in. of cable protruding through the slot for connections.

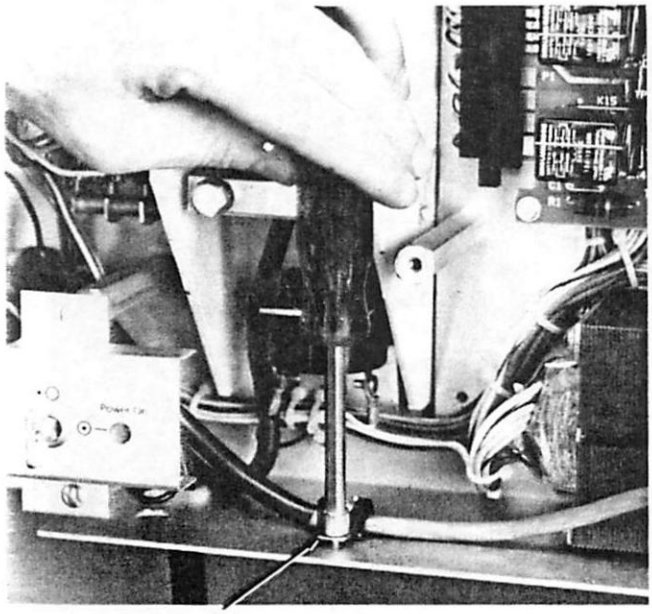


F59829-77

CAUTION

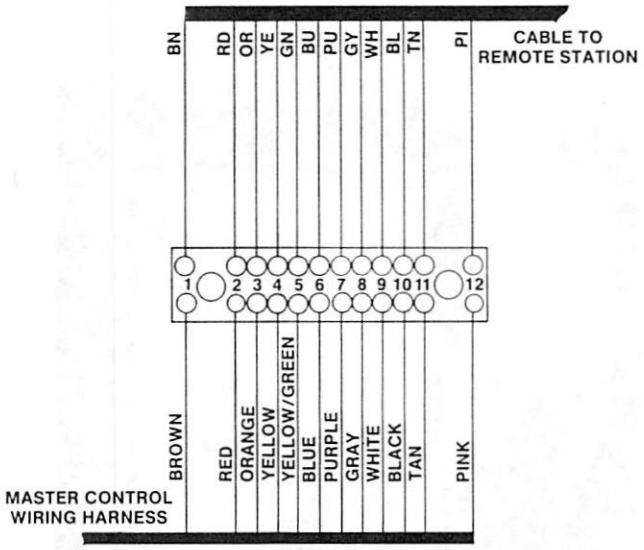
Make sure the cable inside the control or junction box is covered with the insulating jacket (spaghetti) from the point it enters the junction box or control via the handswitch opening to the handswitch cable clamp.

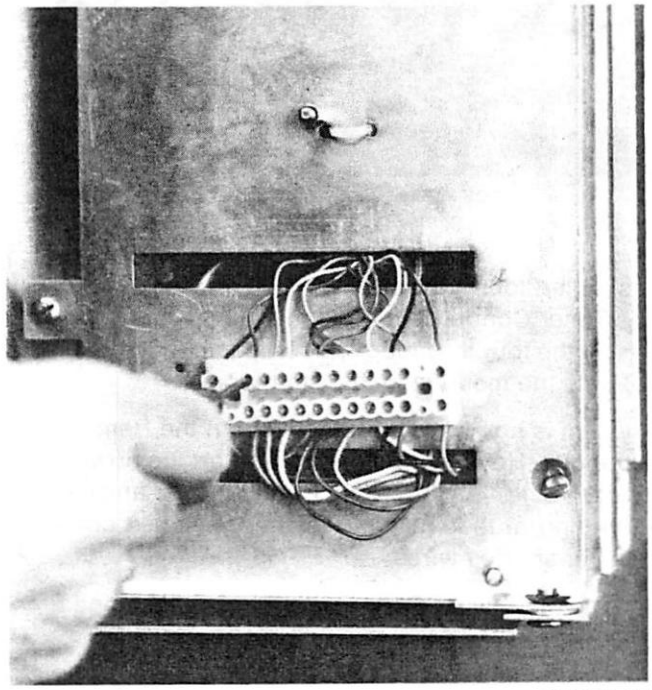
21. Use the handswitch cable clamp to secure the remote cable in place.



F59829-79

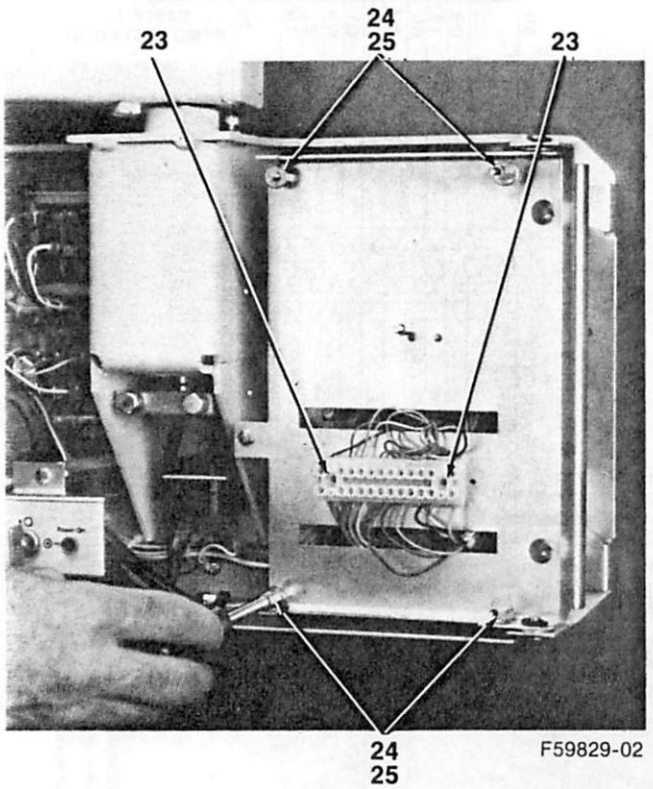
22. Connect the remote cable and control wires color to color to the furnished terminal strip. See diagram below for suggested color sequence.





F59829-82

23. Install the furnished screws through the terminal strip and into the holes in the Timer Control Board mounting plate. Tighten both screws.



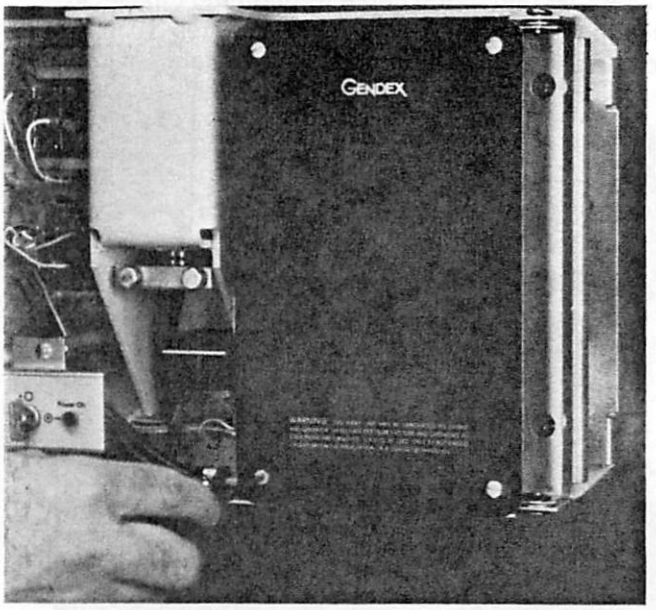
F59829-02

24. Install the four washers, removed in Step 5, onto the Timer Control Board mountng plate studs.
25. Install the four threaded spacers removed in Step 13 onto the mounting plate studs.

The system is now ready for checkout in the Remote Station mode. However, before turning on the power, check connections at the Timer Control Board and the terminal strip at the wallplate master for loose connections or shorted wires.

26. Locate the Master Control graphic panel shipped with the remote kit.

27. Install the graphic panel in place on the four spacers using the four screws removed in Step 10.

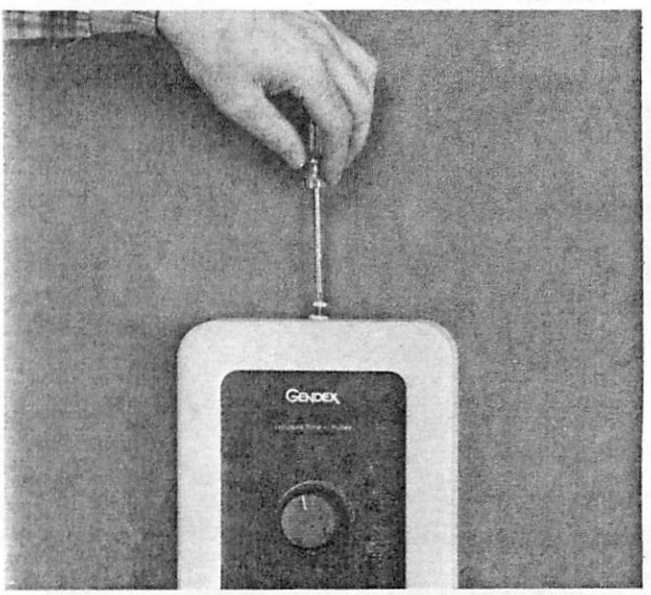


F59829-05

28. Conduct the Electrical Calibration, Section 3.

NOTE: If an audible signal is required at the Remote Station, a sonalert (Part No. 46-404734P1), may be ordered from GENDEX and installed on the Timer Control Board in the Remote Station. On early models, the sonalert must be soldered to the board. Later models will be provided with sockets.

29. Install the Remote Station cover, bezel, removed in Step 3.



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Proceed to Sections 4, 5, and 6 for System Function Checks, Certification and Final Assembly.

SECTION 9
ELECTRICAL TROUBLESHOOTING AND SCHEMATICS

This troubleshooting guide includes technical data to identify and repair electrical malfunctions.

SIMPLIFIED THEORY OF OPERATION

The following simplified theory of operation briefly discusses the function of the GX-770 components. This information is provided to give the service representative a general understanding of this unique system.

GENERAL

The GX-770 uses an automatic line voltage compensation system to provide a preset voltage to the tubehead primary for maintaining a preset value of 70 kVp. This combined with digital exposure timing and readout, provides consistent density radiographs for a wide range of line voltages.

TIMER CONTROL BOARD

This circuit board contains 1) digital electronics for control of the exposure time display, exposure timing, and required tubehead preheat time. A single switch selected code improves the assurance that the exposure time will be equal to the display time. 2) Automatic line voltage compensation circuitry. This circuitry continuously monitors the incoming line voltage. However, no signal is transmitted to the sequence relays, located on the Relay Circuit Board, until an exposure switch is pressed. This prevents continuous operation of relays K13, K14 and K15 as line voltages change. 3) Exposure start circuitry including preheat delay.

RELAY CIRCUIT BOARD

This circuit board contains 1) automatic line voltage compensation relays, K13, K14, and K15. Signals to operate these relays originate from the Timer Control Board. 2) Preheat start and exposure termination via SCR's Q2 and Q3. 3) Exposure start via Triac Q1.

RELAY K1

K1 provides a backup or safety exposure interrupt in the event of a failure of Q1, Q2 or Q3.

TRANSFORMER, T1

T1 provides the autotransformer requirement needed to assure that a consistant voltage, regardless of line voltage variations prior to pressing the handswitch, is always applied to the tubehead. The various taps are binary coded and switched through K13, K14, and K15 to provide this consistent voltage. T1 input to the Timer Control Board also supplies power to the 24VDC power supply and the input to the line voltage sensing circuits.

TRANSFORMER T2

T2 provides power to the Timer Control Board for the 12VDC and 5VDC power supplies. It also provides the line sync pulses for the timer circuit and also exposure start sequence.

RESISTORS R1, R2, and R3

R1 and R3 in conjunction with SCR's Q2 and Q3 provide the series resistance and load resistance respectively for operation of the tubehead inverse voltage suppression circuit. R2 provides the series resistance required during the 22 impulses of preheat. R2 is shunted by Triac Q1 during exposure time.

EXPOSURE SEQUENCE

1. Turn on Master Control.
   - Ready lamp lights.
   - Digital readout lights.
   - 24 VDC present between TS1-9(+) and TP-4(–) on Timer Control Board.
   - 12 VDC present between J2-4(+) and J2-5(–) on Timer Control Board.
   - 5 VDC present between J2-8(+) and J2-3(–) on Timer Control Board.
2. Press exposure switch.
   - K-100 safety relay pulls in.
   - Relays K13, K14 and K15 on Relay Circuit Board pull in according to incoming line voltage.
   - Preheat SCR's, Q2 and Q3, turn on via TP-7(–) to TP-12(+) on Relay Circuit Board.
   - Reduced voltage applied to tubehead for filament preheat.
   - Begin 22 impulse tubehead preheat period.
3. After 22 impulse tubehead preheat period.
   - Exposure triac, Q1, turns on via TP-8(+) to TP-9(–) on Relay Circuit Board.
   - Timed X-ray exposure begins.
4. After selected exposure time.
   - Q1, Q2 and Q3 on Relay Circuit Board turn off.
   - Input voltage to tubehead goes to 0.
   - Exposure terminates.
5. Release Exposure switch.
   - K100 safety relay drops out

TROUBLESHOOTING

NOTE: Following all electrical troubleshooting, perform the complete electrical calibration in Section 3.

Sympton — X-ray cannot be seen on a fluorescent screen.

EXPOSURE TIME SET TO 99 PULSES

STEP	TEST POINT	CONDITION	EXPECTED RESULT	INSTRUCTIONS	
1A		Control On.	Ready Lamp and LED display lights	Yes	Go to Step 1B
				No	Check Fuse F4
1B		Control On. Press handswitch.	K-100 Relay pulls in.	Yes	Go to Step 2A
				No	Go to Step 6A
2A	Tubehead terminals 3 and 4	Control On. Press handswitch.	105 to 117 VAC	Yes	Replace Tubehead
				No	Go to Step 3A
3A	RCB* TP-6 and TP-13	Control On. Press handswitch.	105 to 117 VAC	Yes	Check wiring to TS-36 4 and suspension cable — check K100
				No	Go to Step 4A
4A	TP-7 (–) and TP-12 (+) on RCB*	Control On. Press handswitch.	24 VDC	Yes	Go to Step 5A
				No	Go to Step 4B
4B	TCB** connector strip terminals 9 (+) 15 (–)	Control On. Press handswitch.	24 VDC	Yes	Check wiring harness
				No	Replace TCB**
5A	RCB* TP-5 and TP-13	Control On.	105 to 130 VAC	Yes	Replace RCB
				No	Go to Step 5B

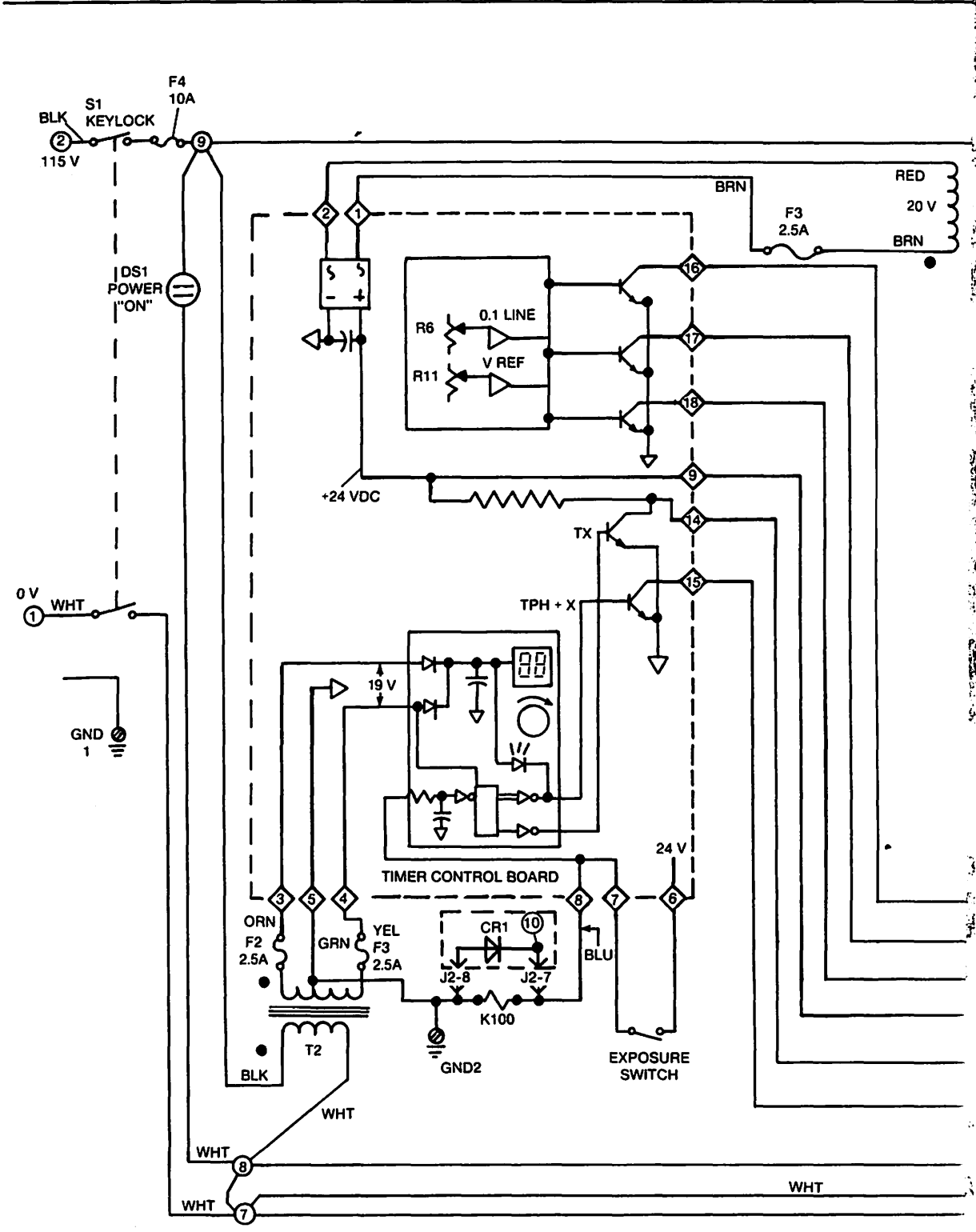
STEP	TEST POINT	CONDITION	EXPECTED RESULT	INSTRUCTIONS	
5B	RCB* TP-1 and TP-13	Control On.	105 to 130 VAC	Yes	Check and replace K13, K14 and K15 or replace RCB*
				No	Check wiring TP-1 to TS1-9
6A	TCB** connector strip terminal 8 (+) to GND	Control On. Press handswitch.	24 VDC	Yes	Check K100 wiring or replace K100
				No	Go to Step 6B
6B	TCB** connector strip terminal 6 (+) and 7 (-)	Control On. Press handswitch.	0 VDC	Yes	Go to Step 6C
				No -24 VDC	Check and replace handswitch
6C	TCB** connector strip terminal 6 (+) to GND	Control On.	24 VDC	Yes	Check TCB** foil runs
				No	Go to Step 7A
7A	TCB** connector strip terminals 1 & 2	Control On.	20 VAC	Yes	Replace TCB**
				No	Go to Step 7B
7B	Across F3 terminals	Control On.	0 V	Yes	Go to Step 7C
				No	Replace F3
7C	Right side of F3 and TCB** connector strip terminal 2	Control OFF, F3 removed.	2 Ohms	Yes	Check T1 (113 V primary) and wiring connections to RCB*
				No Infin-ity	Replace T1
7D	TS1-7 to RCB* TP11	Control On.	105 to 130 VAC	Yes	Go to Step 7D
				No	Go to Step 7E
7E	TS1-7 to RCB* TP1	Control On.	105 to 130 VAC	Yes	Replace RCB*

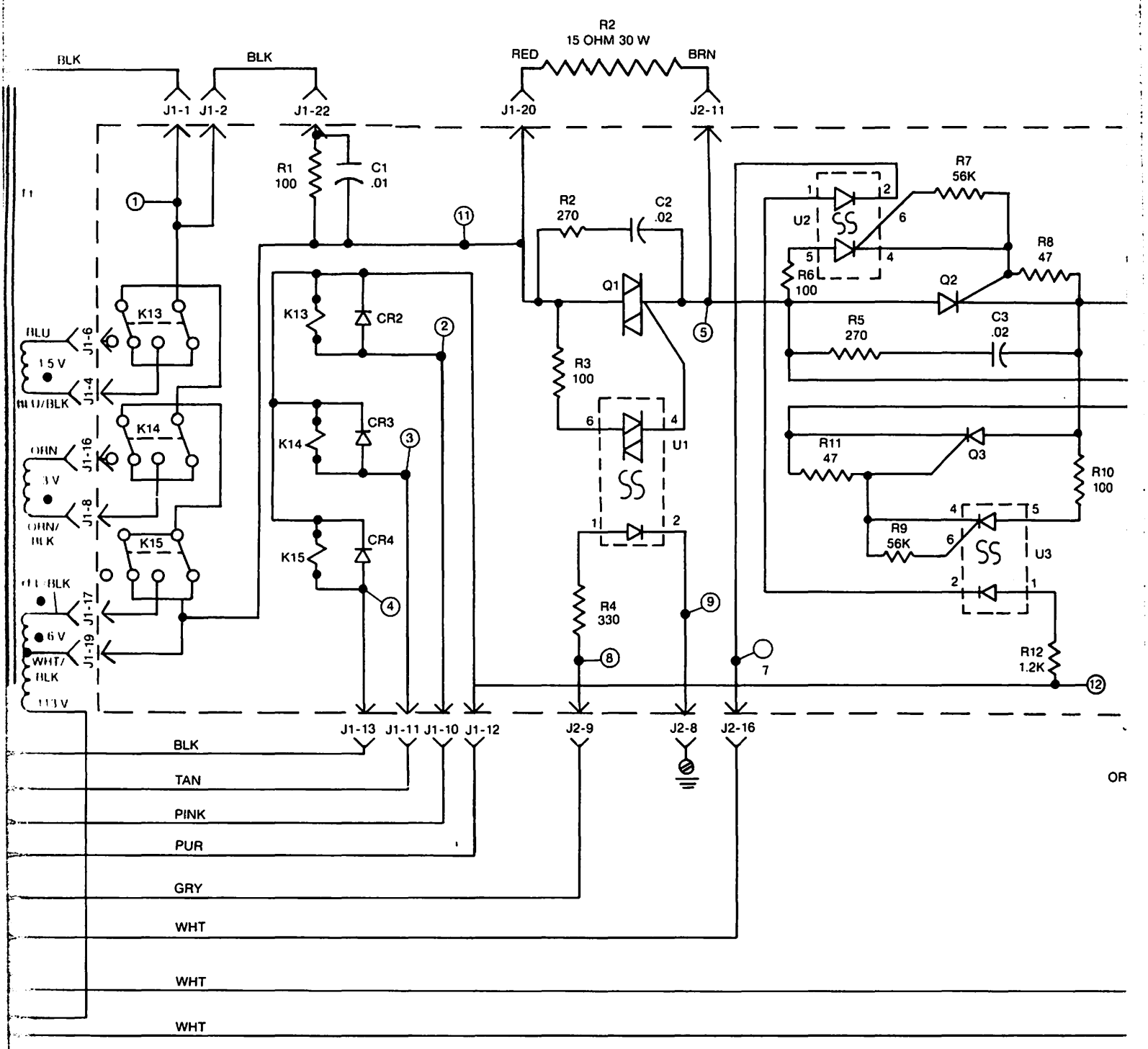
RCB* = Relay Control Board (46-404876G1)
TCB = Timer Control Board (46-404834G1)**

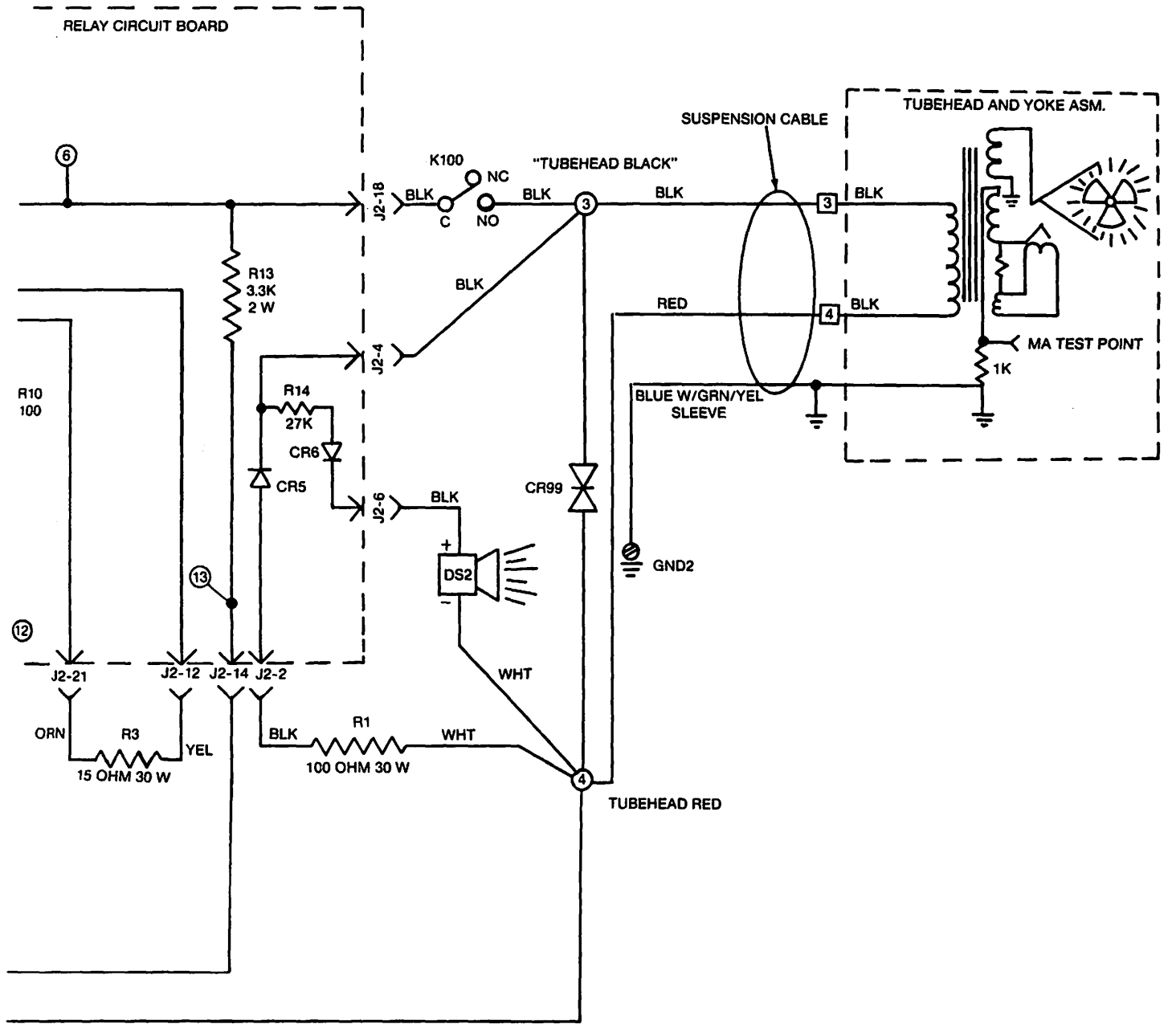
SYMPTOM — LOW X-RAY OUTPUT

STEP	TEST POINT	CONDITION	EXPECTED RESULT	INSTRUCTIONS	
1A	mA test point and ground	Control On. Press handswitch.	7 mA ± 2 mA	Yes	Go to Step 2A
				No	Go to Step 2B
2A	RCB* TP-6 and TP-13	Control On, exposure time 3 pulses. Press handswitch.	25 impulses	Yes	Go to Step 2B
				No	Replace TCB**
2B	Tubehead terminals 3 and 4	Control On, exposure time 99 pulses. Press handswitch.	105 to 117 VAC	Yes	Replace tubehead
				No	Go to Step 3A
3A	RCB* TP-8 (+) and TP-9 (-)	Control On, exposure time 99 pulses. Press handswitch.	6 VDC ± 2V	Yes	Replace RCB*
				No	Go to Step 3B
3B	TCB** connector strip terminal 14 (+) and ground (-)	Control On, exposure time 99 pulses. Press handswitch.	24 VDC ± 2V	Yes	Check wiring harness
				No	Replace TCB**

RCB* Relay Control Board (46-404876G1)
TCB Timer Control Board (46-404834G1)**


F4
10A
S1
KEYLOCK
BLK
2
115 V
9
DS1
POWER
"ON"
2
1
BRN
F3
2.5A
RED
20 V
BRN
16
17
18
0.1 LINE
R6
V REF
R11
9
+24 VDC
TX
14
TPH + X
15
0 V
1
WHT
GND
1
19 V
24 V
TIMER CONTROL BOARD
3
5
4
8
7
6
ORN
F2
2.5A
GRN
YEL
F3
2.5A
CR1
10
J2-8
J2-7
BLU
K100
T2
BLK
GND2
EXPOSURE
SWITCH
WHT
WHT
8
WHT
WHT
7


R2
15 OHM 30 W
RED
BRN
BLK
BLK
J1-1
J1-2
J1-22
J1-20
J2-11
R1
100
C1
.01
R2
270
C2
.02
Q1
R3
100
U1
R4
330
R7
56K
U2
R6
100
R8
47
Q2
R5
270
C3
.02
R11
47
Q3
R10
100
R9
56K
U3
R12
1.2K
K13
K14
K15
CR2
CR3
CR4
BLU
15 V
J1-6
J1-4
BLU/BLK
ORN
3 V
J1-16
J1-8
ORN/
BLK
6 V
J1-17
J1-19
WHT/
BLK
J1-13
J1-11
J1-10
J1-12
J2-9
J2-8
J2-16
BLK
TAN
PINK
PUR
GRY
WHT
WHT
WHT
OR



LEGEND

= TEST POINT # ON RELAY CIRCUIT BOARD

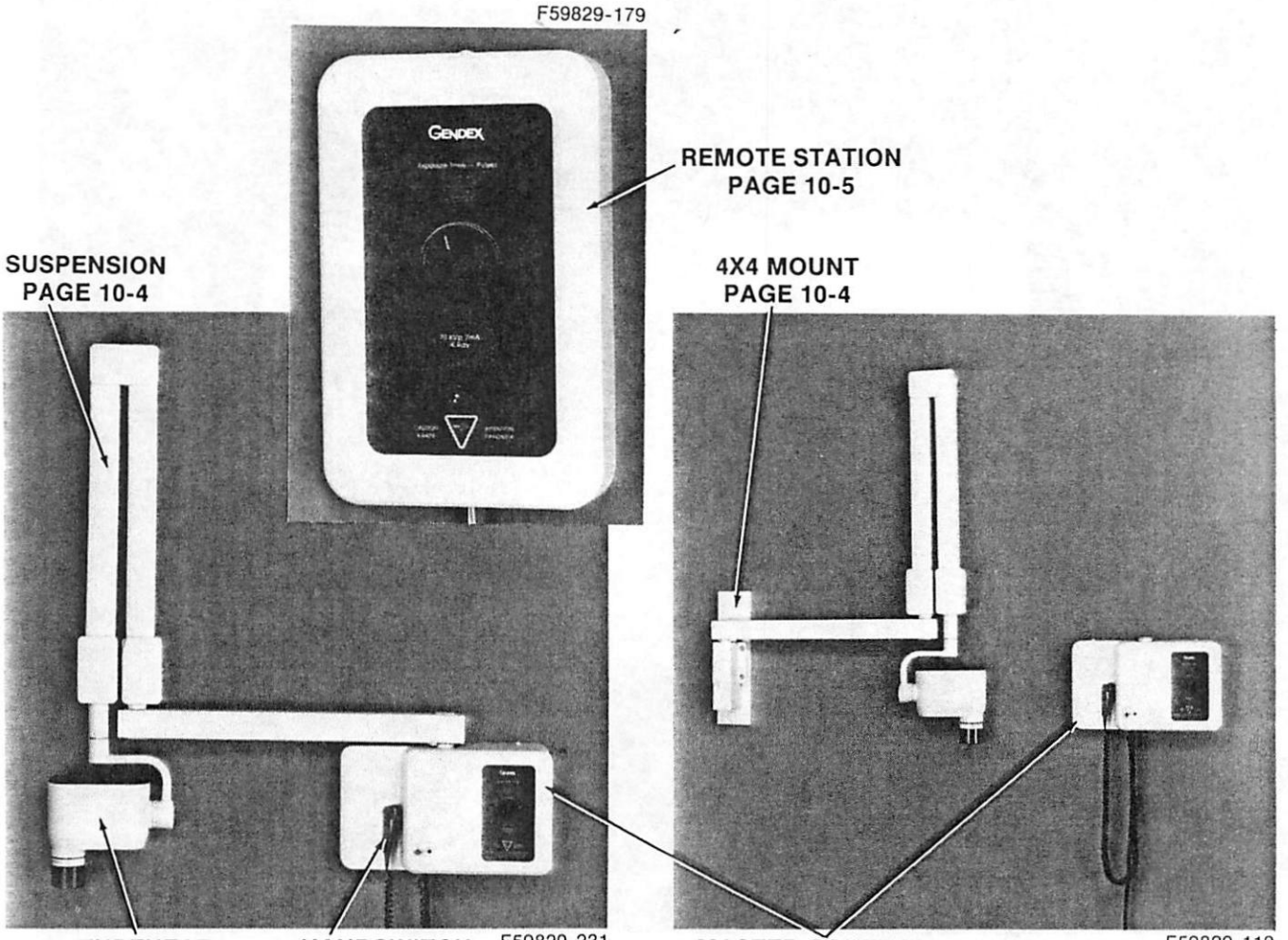
J?-? = PLUG CONNECTIONS # ON RELAY CIRCUIT BOARD

= TSI TERMINAL #

= PLUG CONNECTION # ON TIMER CONTROL BOARD

= TUBEHEAD CONNECTIONS

SECTION 10 — PARTS



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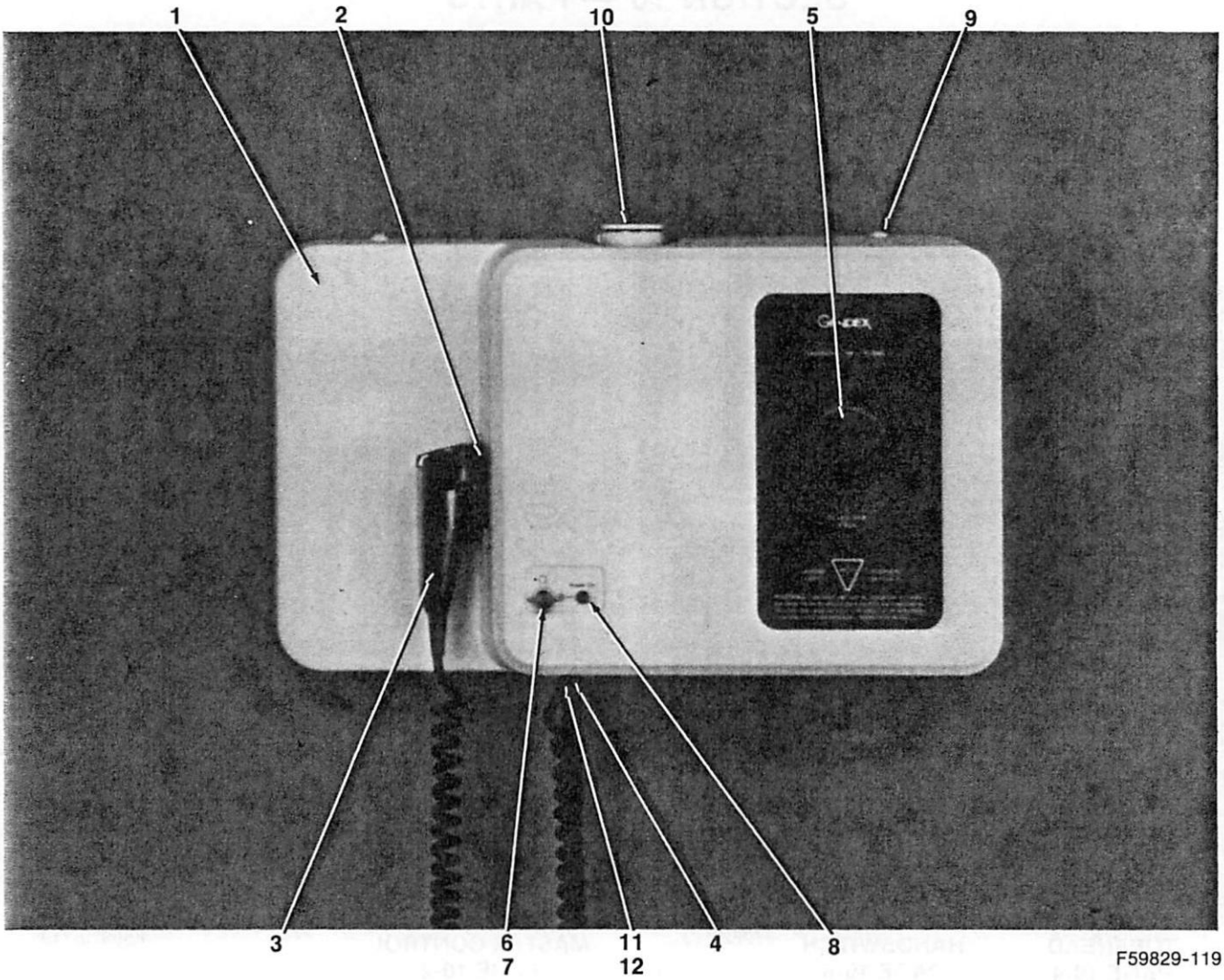
Remote Station, Model 46-404725G1	10-5
Hand Switch and A8108AA Remote Switch	10-6



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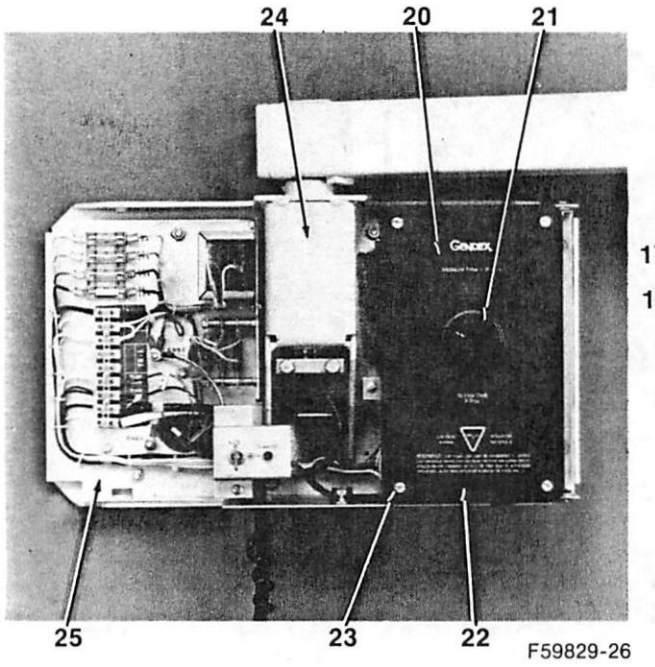
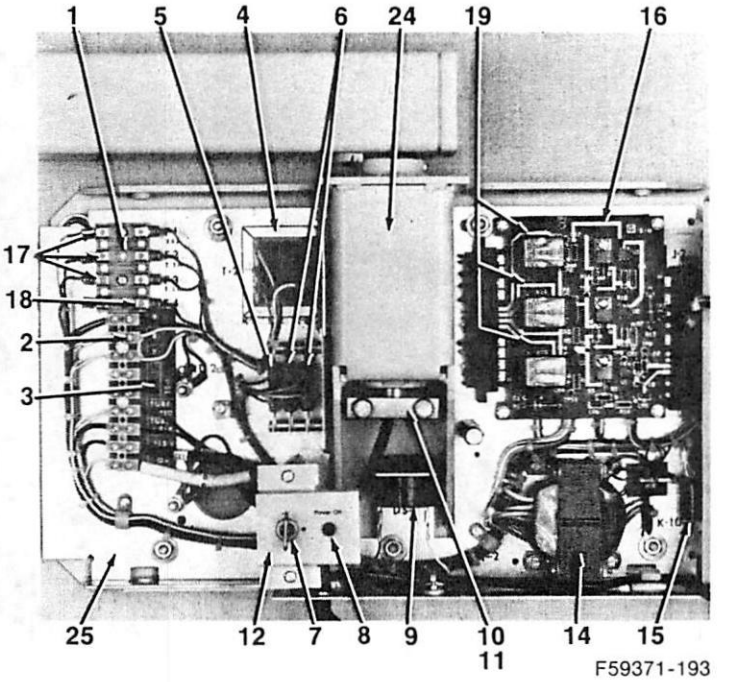
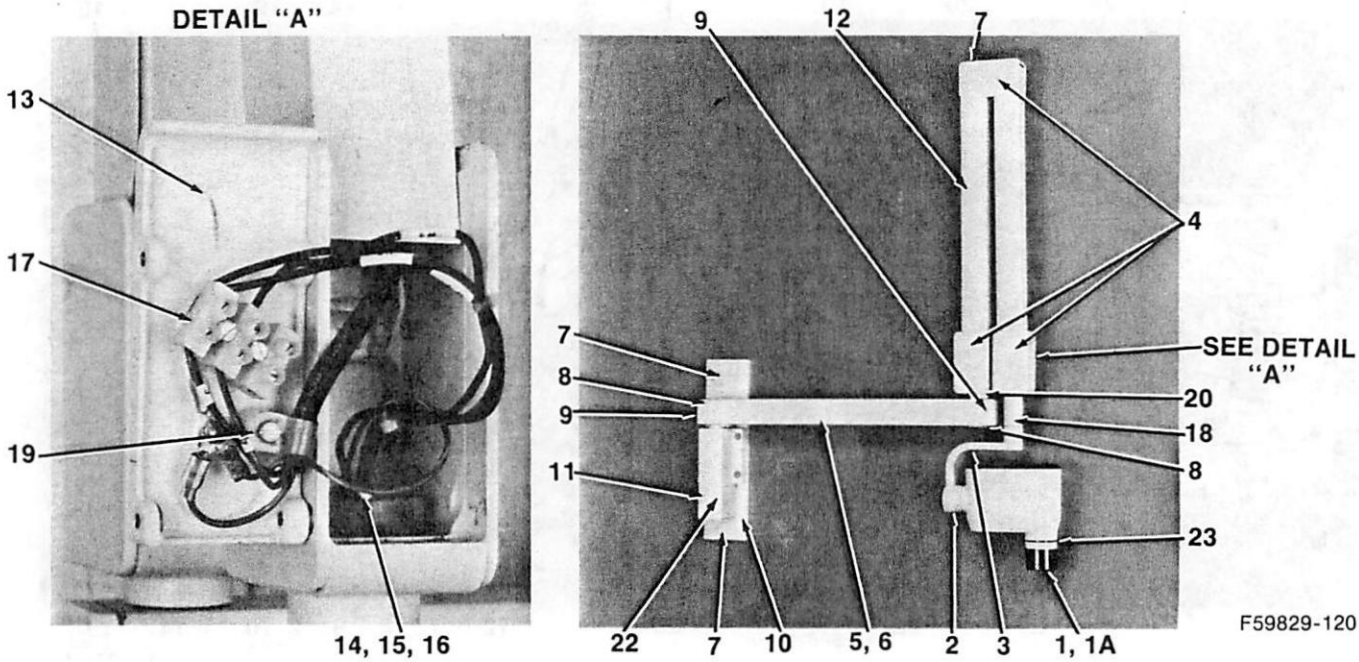
REF. NO.	PART NO.	DESCRIPTION	REMARKS
1	46-404865P1	MASTER CONTROL COVER	Classic white only
2	46-197232G1	HANDSWITCH HOOK	With stick-on tape
3	46-197334G4	HANDSWITCH	See page 10-6 for components
4	100005G1	LINE CORD ASSEMBLY	
5	46-404712P1	TIME SELECTOR KNOB	
6	46-404709P1	KEY LOCK SWITCH	Includes key
7	100120P1	KEY	
8	46-158899P1	AMBER NEON LAMP	"Ready"
9	100012P1	COVER SCREWS	4 used
10	100053P2	PIVOT COVER PLUG	1 used
11	66-652	SPLIT-CLAMP GROMMET	For handswitch cable
12	46-208694P1	RECTANGULAR GROMMET	Used with line cord

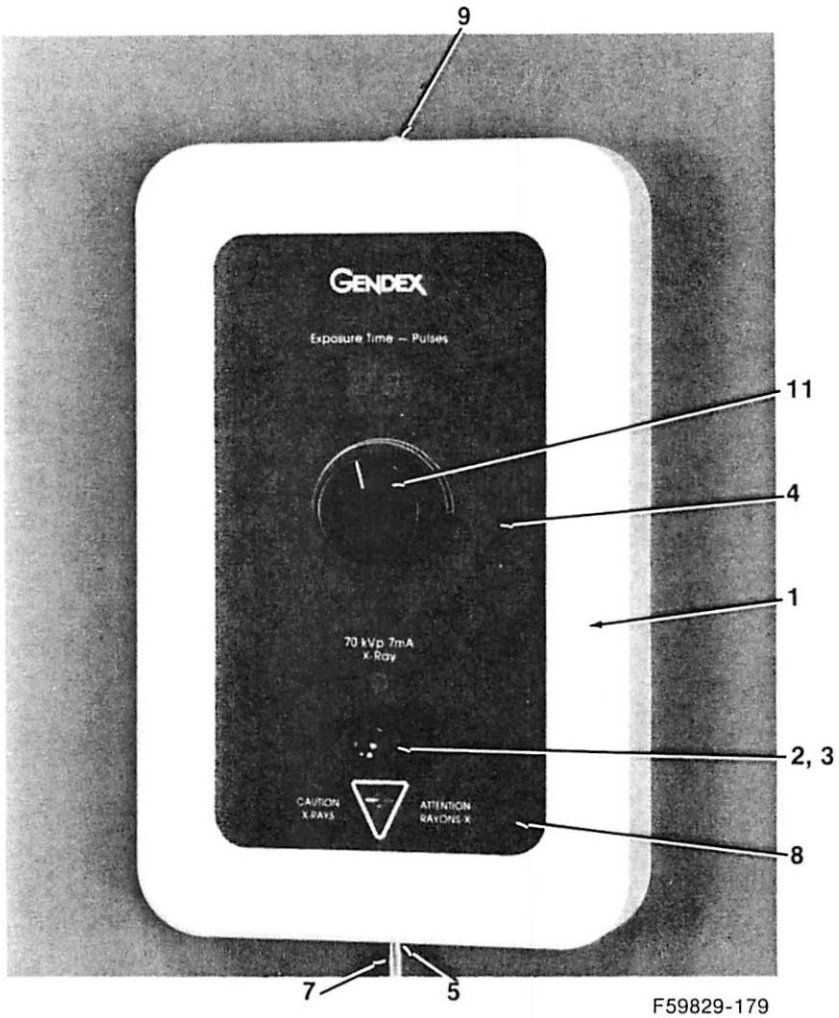




REF. NO.	PART NO.	DESCRIPTION	REMARKS
1	46-404706P4	FUSE HOLDER BLOCK, 4 UNIT	For F1, F2, F3 & F4
2	46-404549P9	TERMINAL STRIP TS-1	TS-1
3	46-404732P1	MARKER STRIP	For TS-1
4	46-404715P1	TRANSFORMER	T2
5	46-404708P1	RESISTOR 100 ohm, 30W	R1
6	46-404708P2	RESISTOR 15 ohm, 30W	R2, R3
7	46-404709P1	KEY LOCK SWITCH	S1
8	46-158899P1	AMBER NEON LAMP	"Ready"
9	46-181048P1	SONALERT	
10	100114G1	HORIZONTAL ARM BRAKE ASSEMBLY	
11	46-404879P1	BRAKE PAD	
12	100113G1	KEY LOCK MOUNTING PLATE W/GRAPHICS	
14	46-404705P1	TRANSFORMER	T1
15	46-404515P4	RELAY 24V DC COIL SPDT	K100
16	46-404876G1	RELAY CIRCUIT BOARD	
17	46-170021P8	FUSE, 2.5 A, 250V - 3AG	F1, F2 & F3
18	46-170021P42	FUSE, 10 A, 250V - 3AB	F4
19	100070P1	RELAY, 24 VDC COIL DPDT	For relay circuit board
20	46-404834G1	TIMER CONTROL BOARD	Behind #22
21	46-404712P1	TIME SELECTOR KNOB	
22	100112G1	GRAPHIC PANEL W/BACK PLATE	
23	46-404731P1	STANDOFF	For graphic panel, 4 used
24	46-404853P2	WALLPLATE	
25	46-404710G1	COMPLETE ELECTRICAL SUB CHASSIS	



REF. NO.	PART NO.	DESCRIPTION	REMARKS
1	D0774B	8" FOCAL LENGTH CONE	
1A	D0774A	12" FOCAL LENGTH CONE	
2	46-404721P1	YOKE END CAP	
3	100117G1	YOKE	Includes bearing & angle indicator
4	46-404884P1	SUSPENSION COVERS	6 used
5	46-404809G1	HORIZONTAL ARM - 27 INCHES	Includes stop
6	46-404809G2	HORIZONTAL ARM - 18 INCHES	Includes stop
7	46-404897P1	PLUG BUTTON	1 used on suspension 3 used on 4X4 mount
8	46-404898P1	PLUG BUTTON, HORIZONTAL ARM	2 used
9	46-404864P1	HORIZONTAL ARM END CAPS	2 used
10	A0772A	4X4 MOUNT	
11	100052P2	TRIM COVER	Classic white
12	100118G1	EXCHANGE SUSPENSION	Excludes horizontal arm
13	46-404921P2	ACCESS COVER	
14	46-404855P1	RETAINER KEY	Tubehead mounting
15	46-404856P1	KEYED WASHER	Tubehead mounting
16	46-404899P2	PROTECTIVE COVER	For items 14 &15
17	46-404549P3	TERMINAL STRIP	3 position
18	46-404857P1	TUBEHEAD ROTATIONAL STOP	
19	46-220360P3	CABLE CLAMP	
20	43162	THRUST WASHER	
21	46-404924G1	SUSPENSION POWER CABLE	3 conductors
22	46-220179P21	RETAINER CLIP	
23	100064G1	WAVE WASHER	For cone retention
NS	100040P1	SOCKET WRENCH	For spring adjustments
NS	100108P1	LEAD PLUG	For service only



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REF. NO.	PART NO.	DESCRIPTION	REMARKS
1	46-404872P1	BEZEL, COVER	Classic white only
2	46-404733P1	SWITCH, SPST	
3	46-404728P1	SWITCH COVER	For item 2
4	100115G1	GRAPHIC PANEL W/BACKPLATE	
5	46-220360P3	SPLIT CLAMP GROMMET	For remote station cable
6	10035P3	BUSHING	For use in master control
7	A0778A	REMOTE STATION CABLE	Cut to length, 30 ft. min.
8	46-404734P1	AUDIBLE ALERT	Attaches to timer control board when required
9	100012	COVER SCREWS	3 used
10	46-404871P1	WALLPLATE ONLY	
11	46-404712P1	TIME SELECTOR KNOB	
NS	100116G1	GRAPHIC PANEL W/BACKPLATE	For installation into master control when remote station is installed
NS	46-404542P1	TERMINAL STRIP	Installed in master during installation

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